Natural Hazards and Disaster

Class 27: Past and Present Climate Change (continued)

- The Baseline: Past Climate Changes
- The Syndrome: Recent Climate and Global Change
- The Diagnosis: Leaving the “Safe Operating Space”
- The Prognosis: Journey Into the Unknown
- The Therapy: “Lifestyle” changes

Natural Hazards and Disaster

Class 27: Past and Present Climate Change (continued)

- The Baseline: Past Climate Changes
- The Syndrome: Recent Climate and Global Change
- The Diagnosis: Leaving the “Safe Operating Space”
- The Prognosis: Journey Into the Unknown
- The Therapy: “Lifestyle” changes

The Therapy: “Life-Style” Changes

How did we get here?

Adam Smith et al.: Purpose of economy is to create human wealth

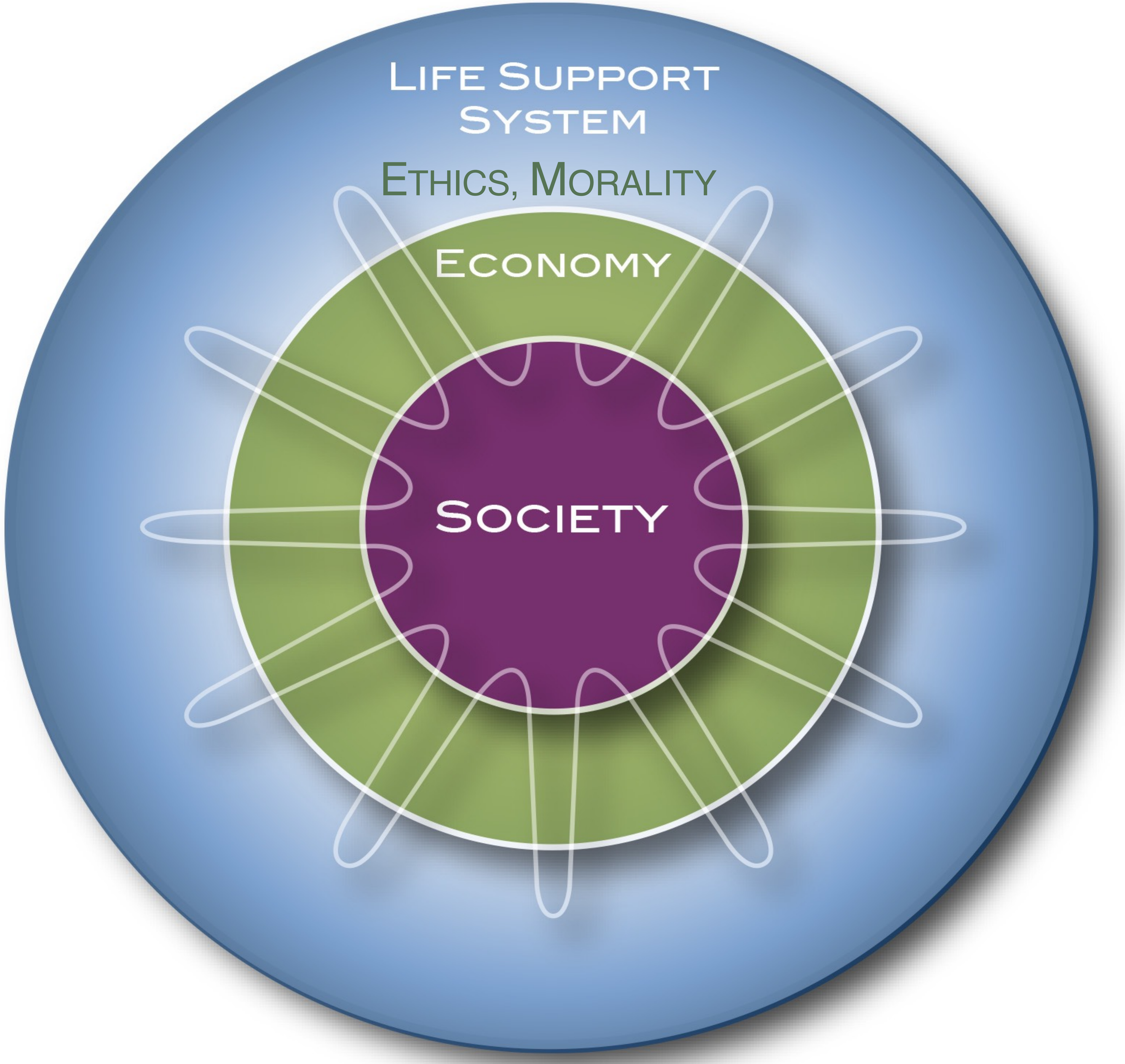
Today: Purpose of economy is growth

Earth: Our Life-Support System

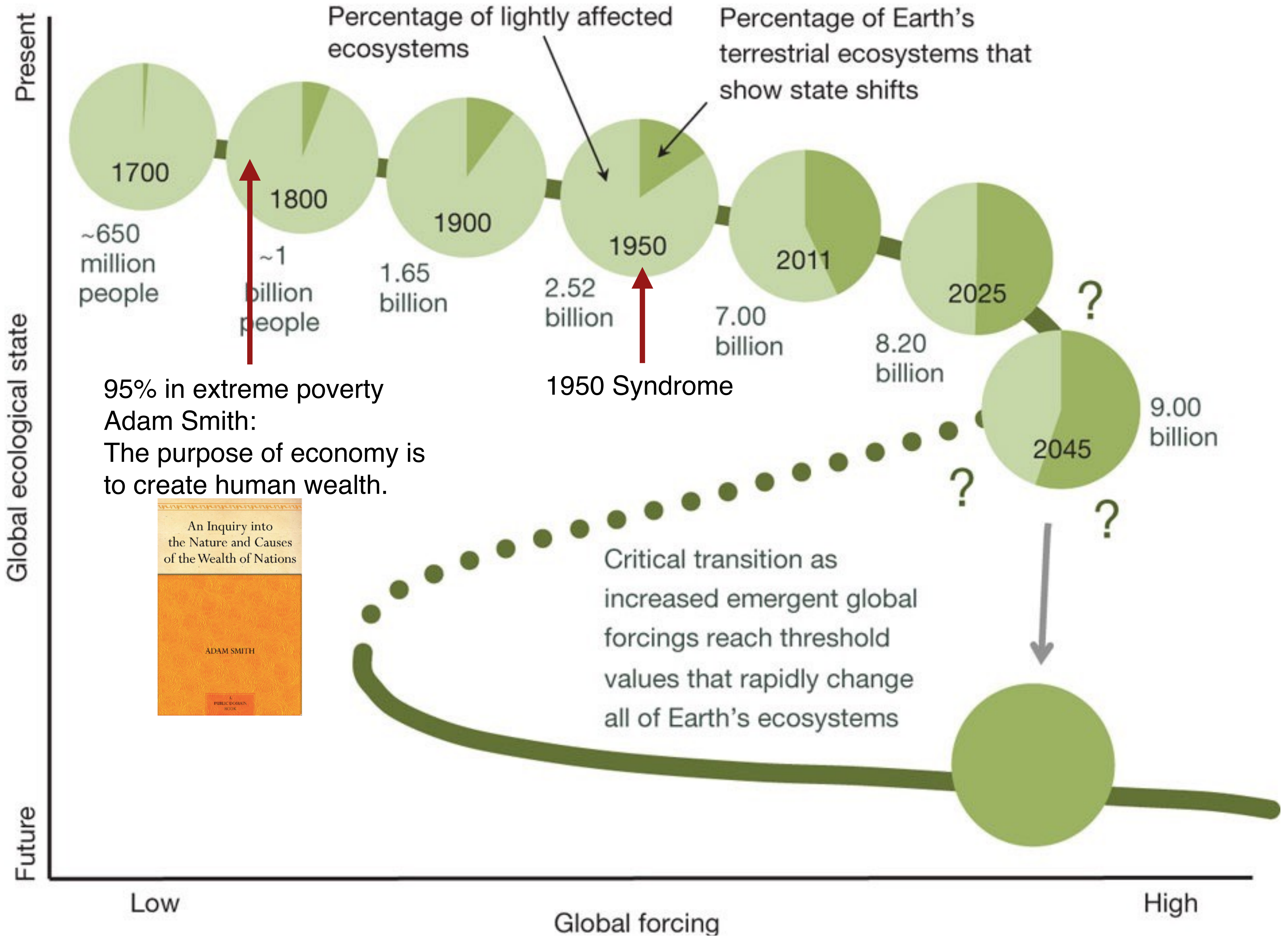
Economy is between us and the Life-Support System

Everything is about Flow

Flows are regulated by ethical and social norms and economic rules



The Therapy: “Life-Style” Changes

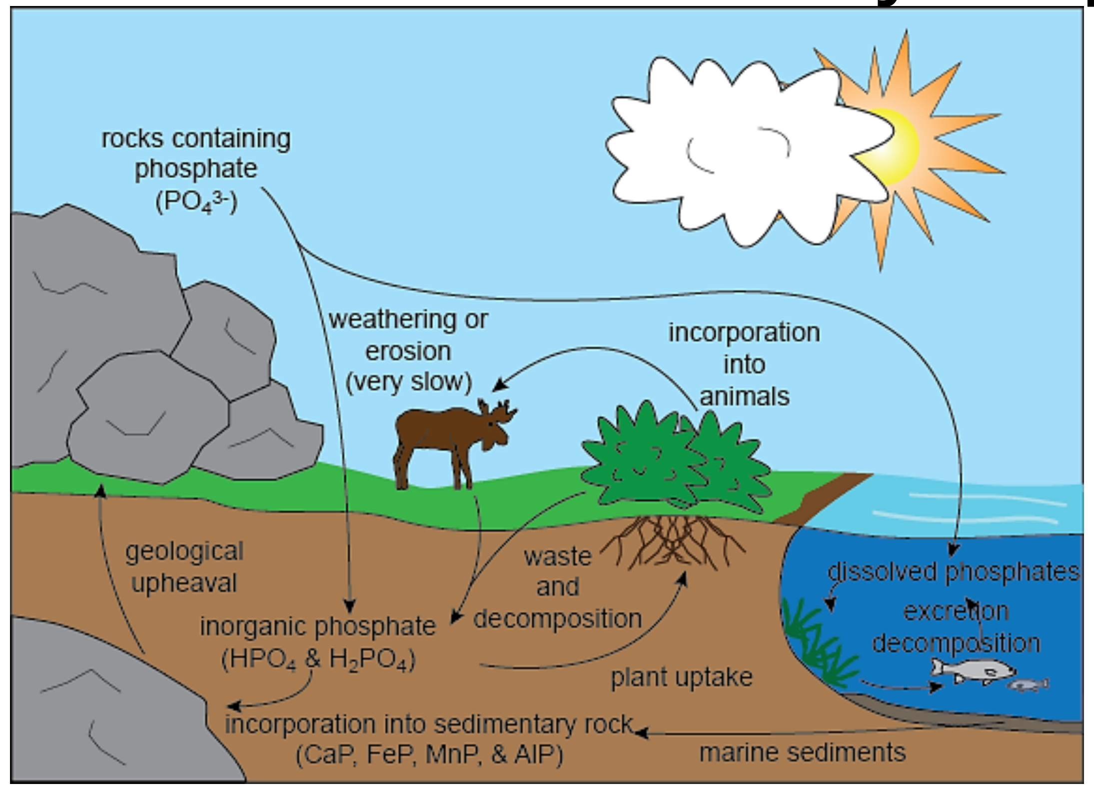


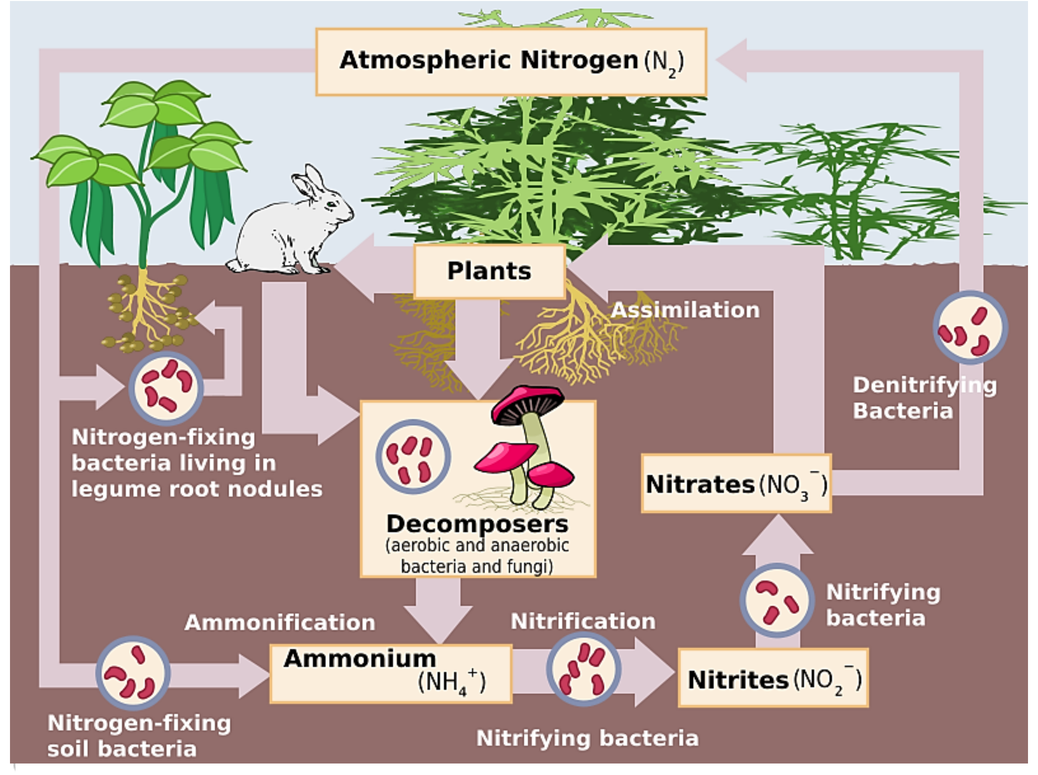
Humanity has been extremely successful as a species on this planet in changing the planet

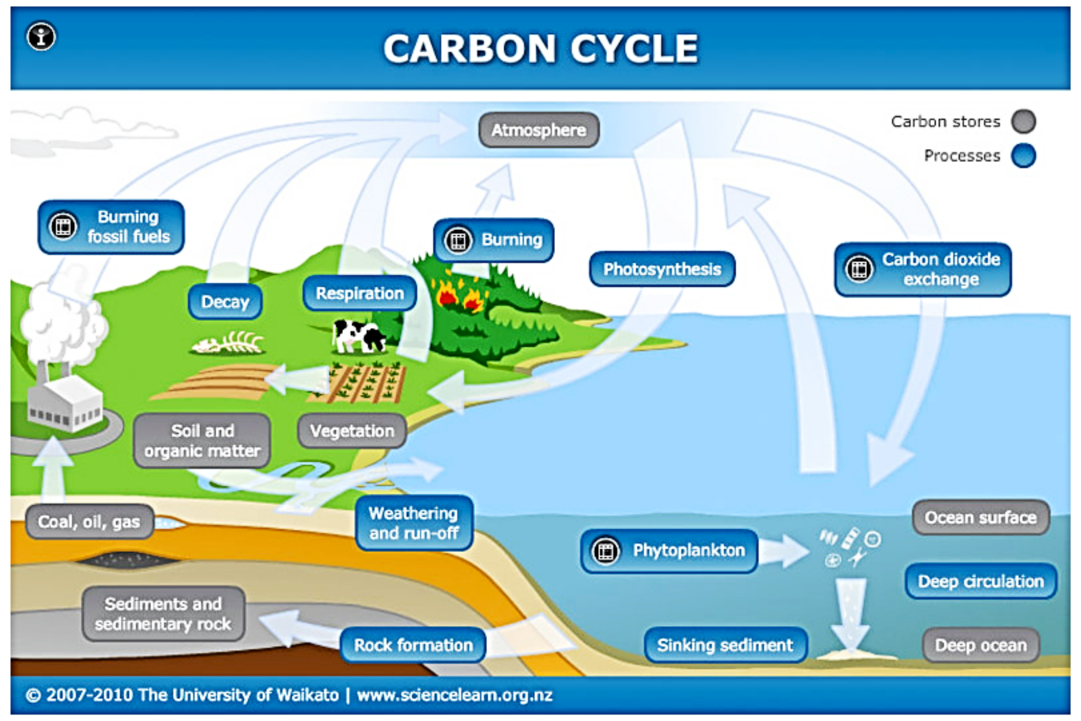
We are the operators of Earth’s life-support system

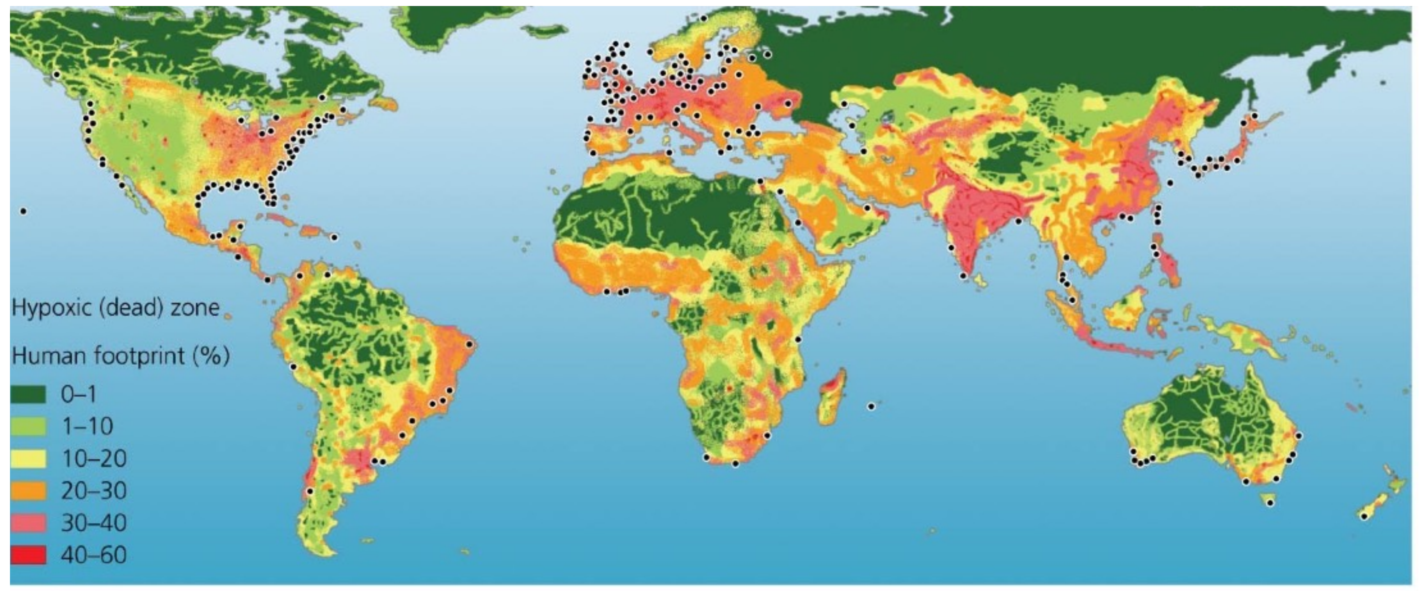
The Therapy: “Life-Style” Changes

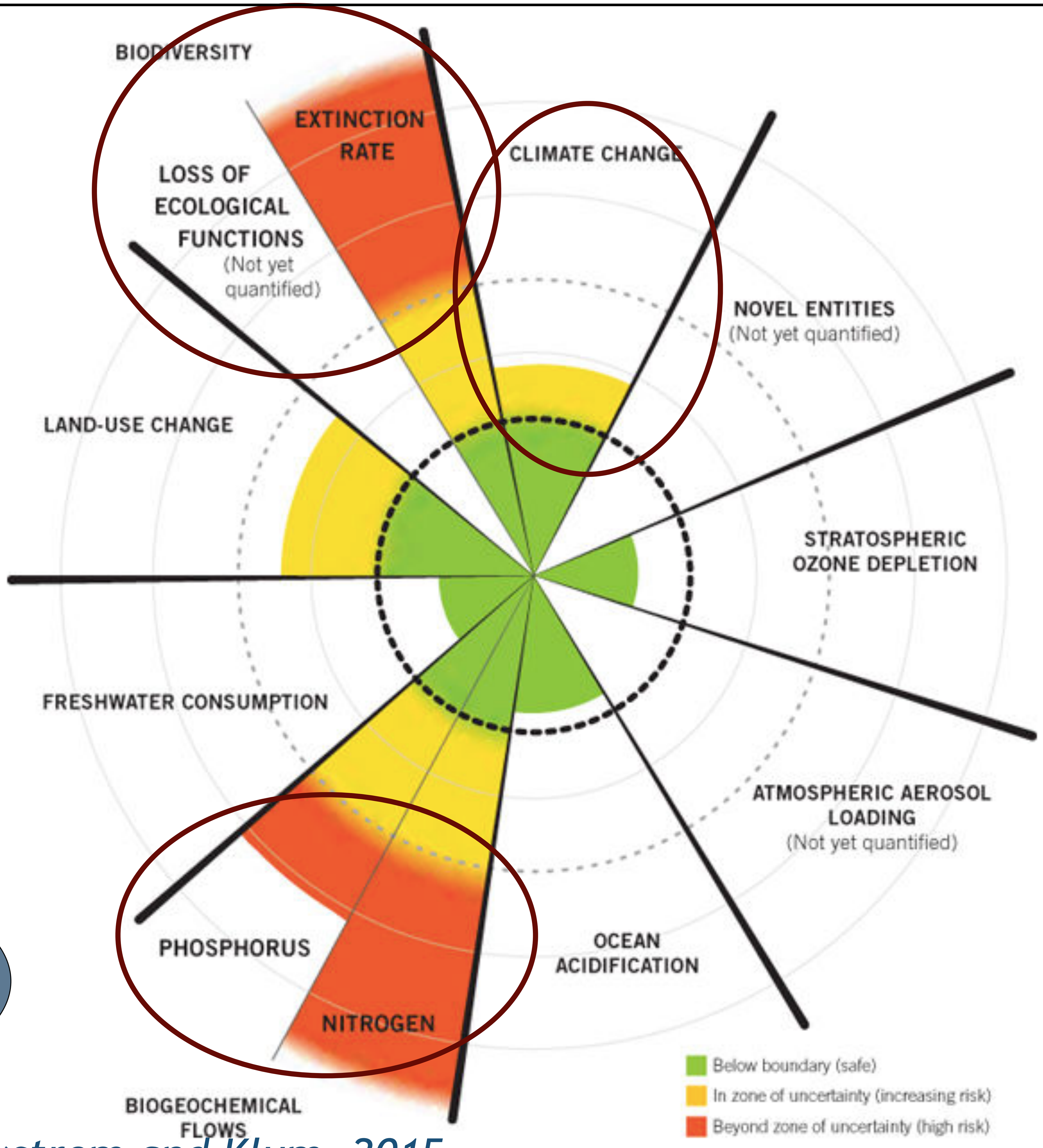
We are heading for a planet without other large mammals - only sapiens left.











Rockstrom and Klum, 2015

We are rapidly reengineering the planet without a clear strategy, a design consideration, a plan

We are the operators of Earth’s life-support system

The Therapy: “Life-Style” Changes

We have an issue …

Leaving the Holocene:

- a uniquely stable period in the history of the Earth’s life support system,
- very beneficial for humans to develop civilization

The Therapy: “Life-Style” Changes

We have an issue …

Leaving the Holocene:

- a uniquely stable period in the history of the Earth’s life support system,
- very beneficial for humans to develop civilization

We have entered a (brief?) period of our making: the Anthropocene

The Therapy: “Life-Style” Changes

We have an issue …

Leaving the Holocene:

- a uniquely stable period in the history of the Earth’s life support system,
- very beneficial for humans to develop civilization

We have entered a (brief?) period of our making: the Anthropocene

Humanity is operating the planetary system and determining the future of the planet

We are rapidly reengineering the planet without a clear strategy, a design consideration, a plan

The Therapy: “Life-Style” Changes

We have an issue …

Leaving the Holocene:

- a uniquely stable period in the history of the Earth’s life support system,
- very beneficial for humans to develop civilization

We have entered a (brief?) period of our making: the Anthropocene

Humanity is operating the planetary system and determining the future of the planet

We are rapidly reengineering the planet without a clear strategy, a design consideration, a plan

Knowing the flows is fundamental for doing a good job

The Therapy: “Life-Style” Changes

We are the operators of Earth’s life-support system

Our leaders are the pilots of spaceship Earth

The Therapy: “Life-Style” Changes

The Earth keeps changing and we keep changing the Earth

We are the operators of Earth’s life-support system

Our leaders are the pilots of spaceship Earth

The Therapy: “Life-Style” Changes

The Earth keeps changing and we keep changing the Earth

Our system knowledge increases

We are the operators of Earth’s life-support system

Our leaders are the pilots of spaceship Earth

The Therapy: “Life-Style” Changes

The Earth keeps changing and we keep changing the Earth

Our system knowledge increases

For the first time, we can see the control levers, knobs and switches that drive the Earth system

We are the operators of Earth’s life-support system

Our leaders are the pilots of spaceship Earth

The Therapy: “Life-Style” Changes

The Earth keeps changing and we keep changing the Earth

Our system knowledge increases

For the first time, we can see the control levers, knobs and switches that drive the Earth system

But we don’t have the control panel, the cockpit to control and operate the system

We are the operators of Earth’s life-support system

Our leaders are the pilots of spaceship Earth

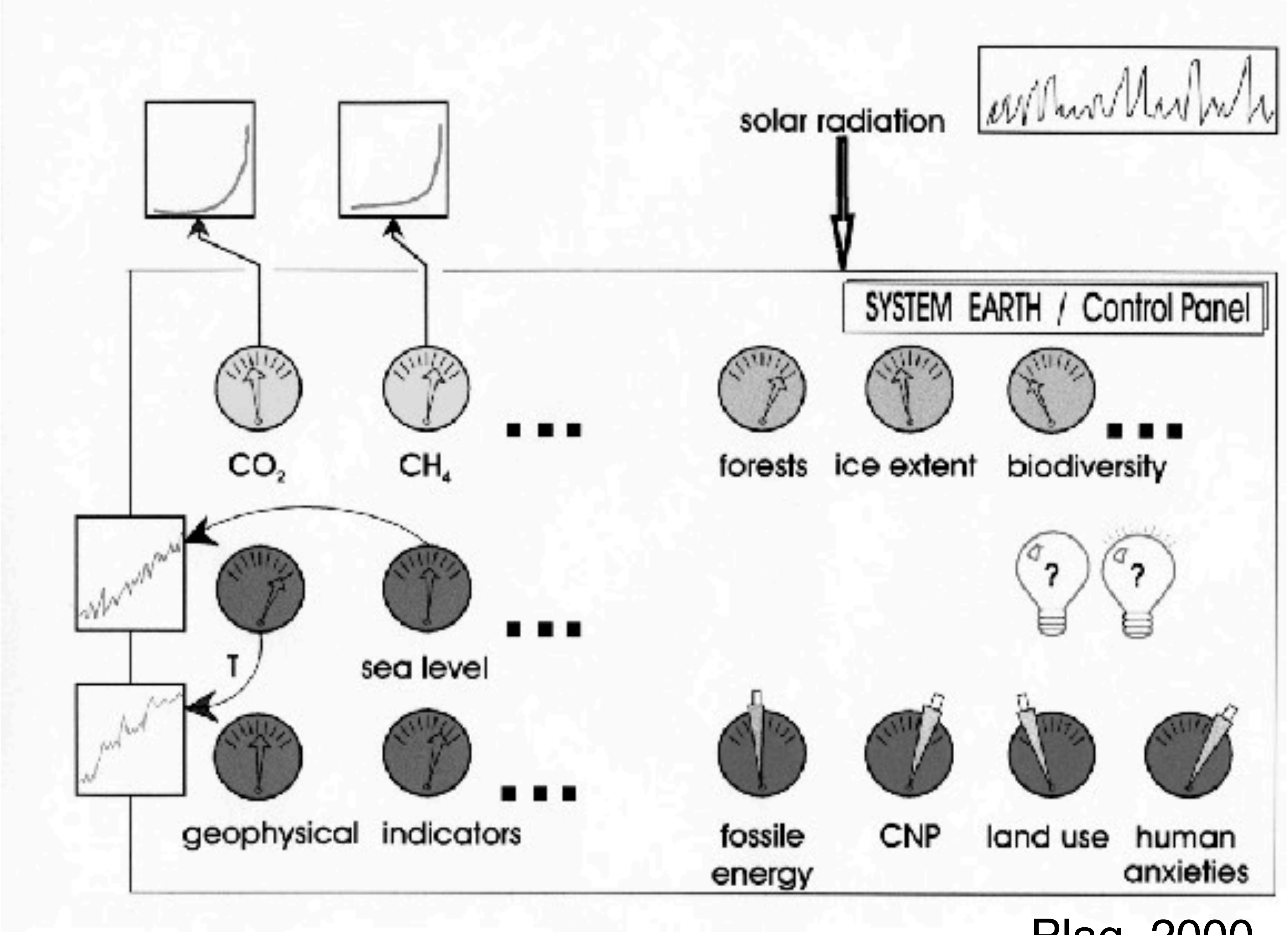
The Therapy: “Life-Style” Changes

The Earth keeps changing and we keep changing the Earth

Our system knowledge increases

For the first time, we can see the control levers, knobs and switches that drive the Earth system

But we don’t have the control panel, the cockpit to control and operate the system



Plag, 2000

We are the operators of Earth’s life-support system

Our leaders are the pilots of spaceship Earth

The Therapy: “Life-Style” Changes

The Earth keeps changing and we keep changing the Earth

Our system knowledge increases

For the first time, we can see the control levers, knobs and switches that drive the Earth system

But we don’t have the control panel, the cockpit to control and operate the system

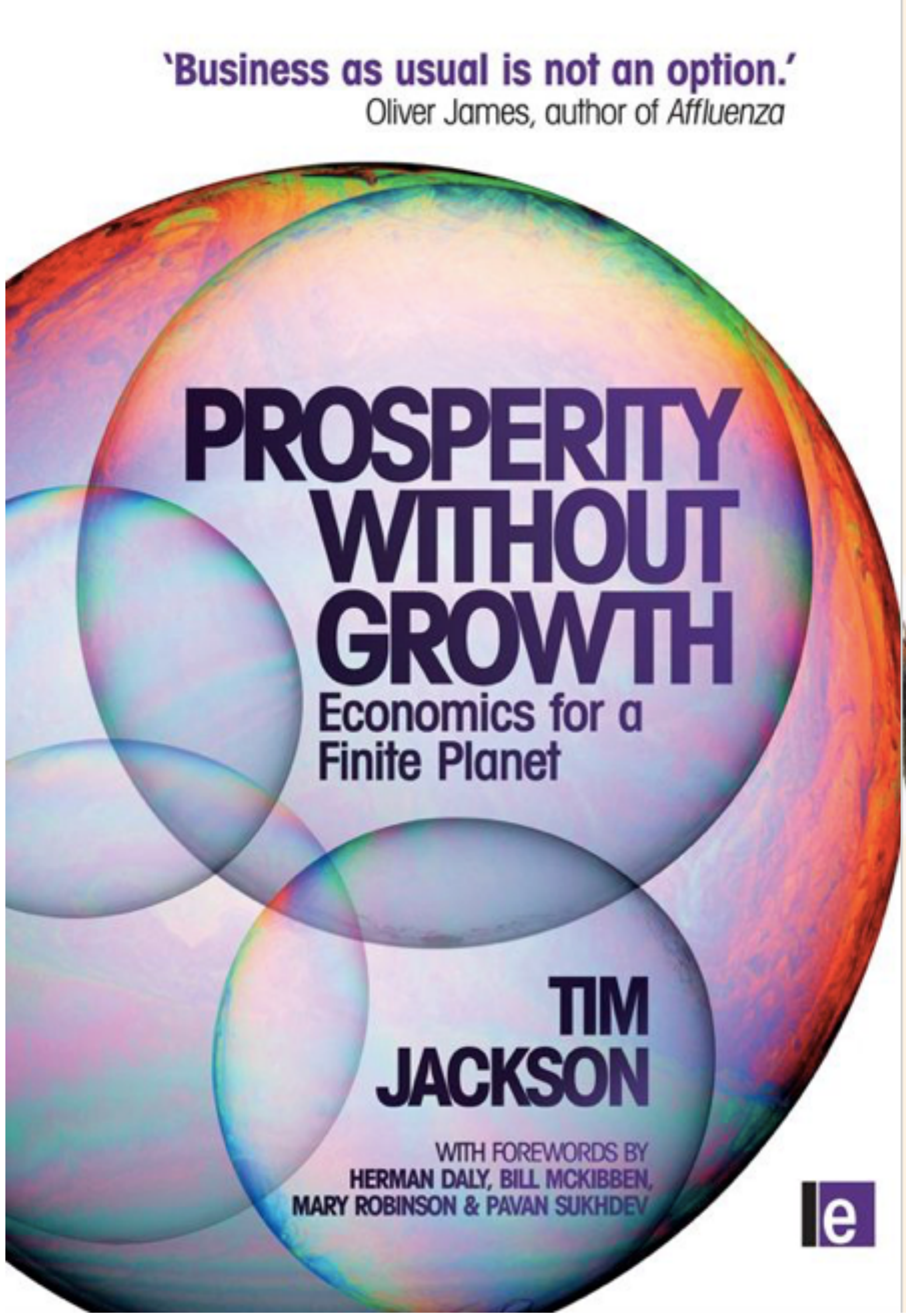
We are the operators of Earth’s life-support system

Our leaders are the pilots of spaceship Earth

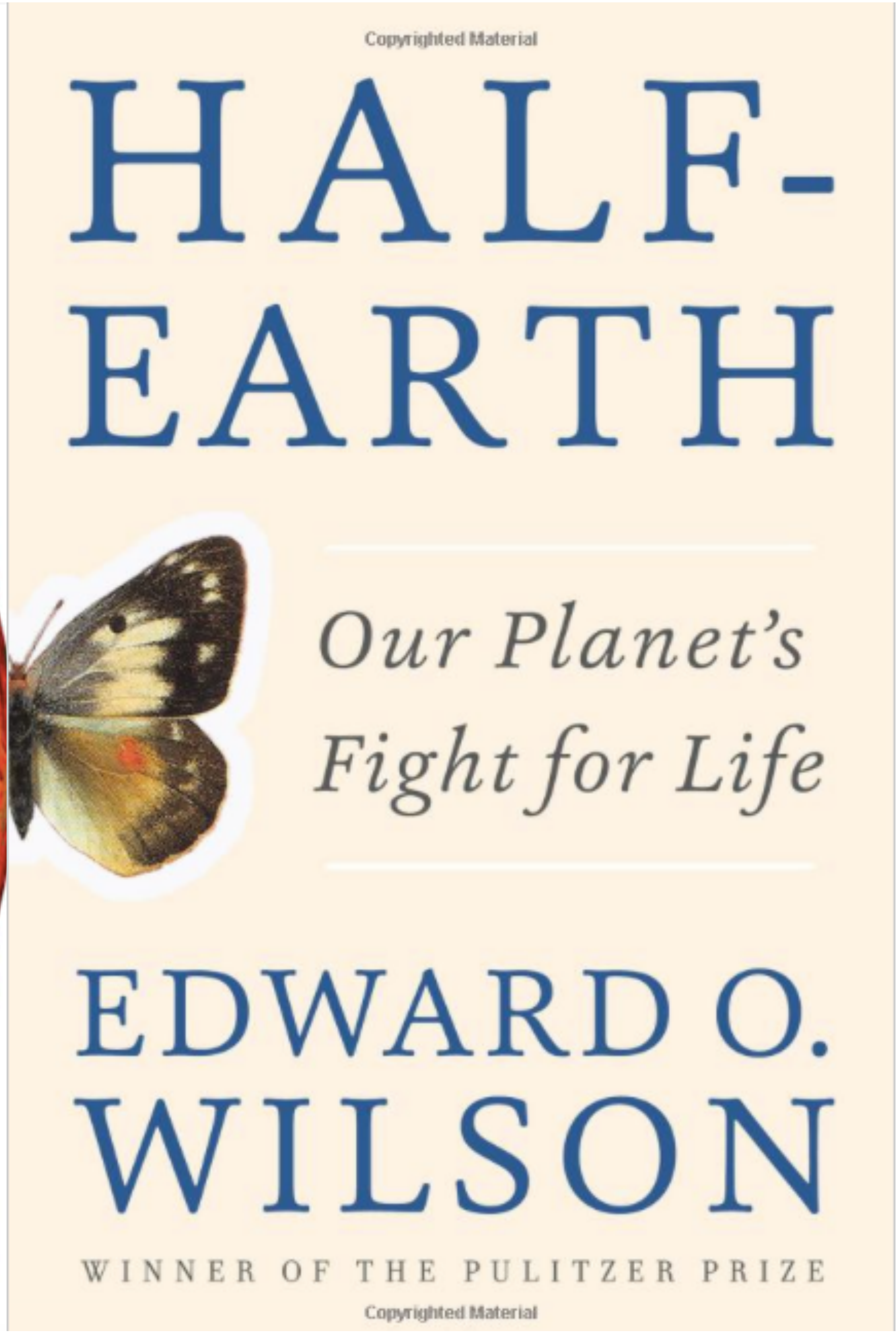
The Therapy: “Life-Style” Changes

The Therapy: “Life-Style” Changes

Published in 1987



Published in 2009



Published in 2016

The Therapy: “Life-Style” Changes

ON THE EDGE°

Safeguarding Our Life Support System

OVERCOMING THE “IMMUTABLE TRUTH” OF GROWTH BEING NECESSARY FOR A THRIVING ECONOMY

Prof. Hans-Peter Plag, PhD
Mitigation and Adaptation Research Institute
Old Dominion University
Norfolk, Va.
www.mari.odu.edu

IN EARLIER COLUMNS, I MADE REFERENCE TO a new definition for sustainable development: a development that meets our needs while safeguarding the Earth’s life support system on which we and all future generations depend. Safeguarding our life support system (LSS) seems logical and to be something we all should be eager and able to agree upon.

The Therapy: “Life-Style” Changes

ON THE EDGE°

Prof. Hans-Peter Plag, PhD

Mitigation and Adaptation Research Institute

Old Dominion University

Norfolk, Va.

www.mari.odu.edu

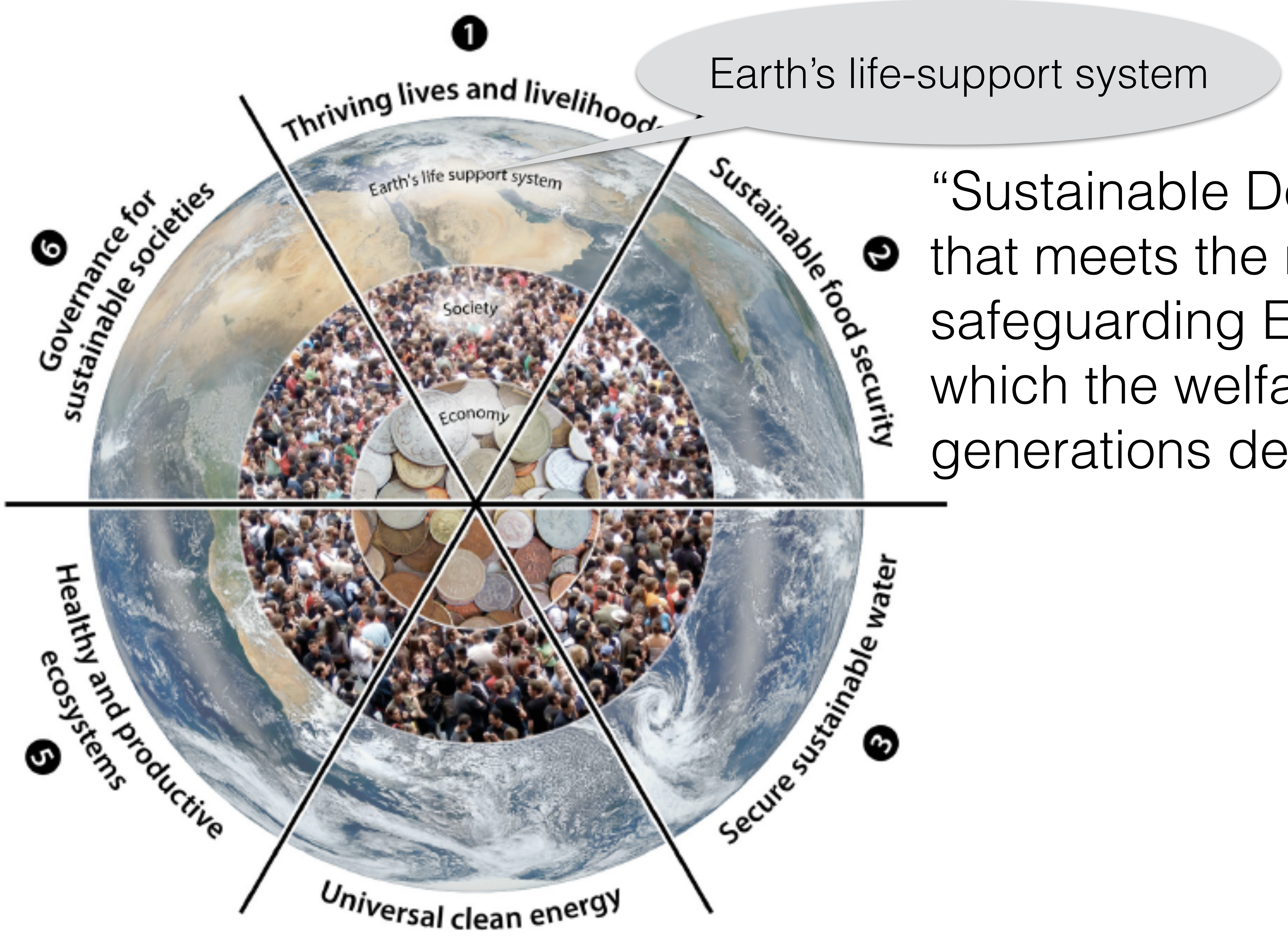
Safeguarding Our Life Support System

OVERCOMING THE “IMMUTABLE TRUTH” OF GROWTH BEING NECESSARY FOR A THRIVING ECONOMY

IN EARLIER COLUMNS, I MADE REFERENCE TO a new definition for sustainable development: a development that meets our needs while safeguarding the Earth’s life support system on which we and all future generations depend. Safeguarding our life support system (LSS) seems logical and to be something we all should be eager and able to agree upon.

The Therapy: “Life-Style” Changes

The Therapy: "Life-Style" Changes

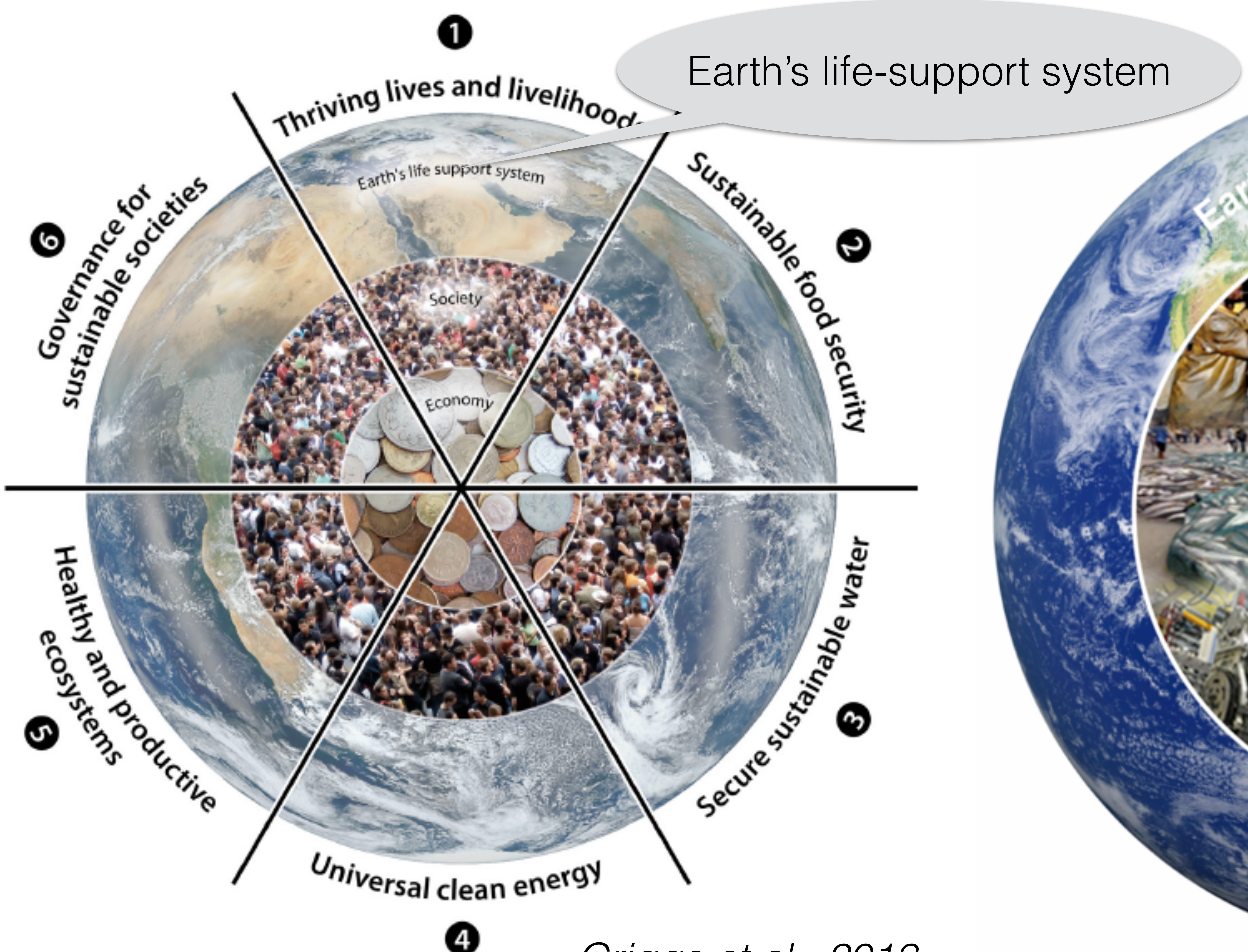


Griggs et al., 2013

Figure 1 | Six universal Sustainable Development Goals cutting across economic, social and environmental domains.

"Sustainable Development is a development that meets the needs of the present while safeguarding Earth's life support systems, on which the welfare of current and future generations depends." (Griggs et al., 2013)

The Therapy: “Life-Style” Changes

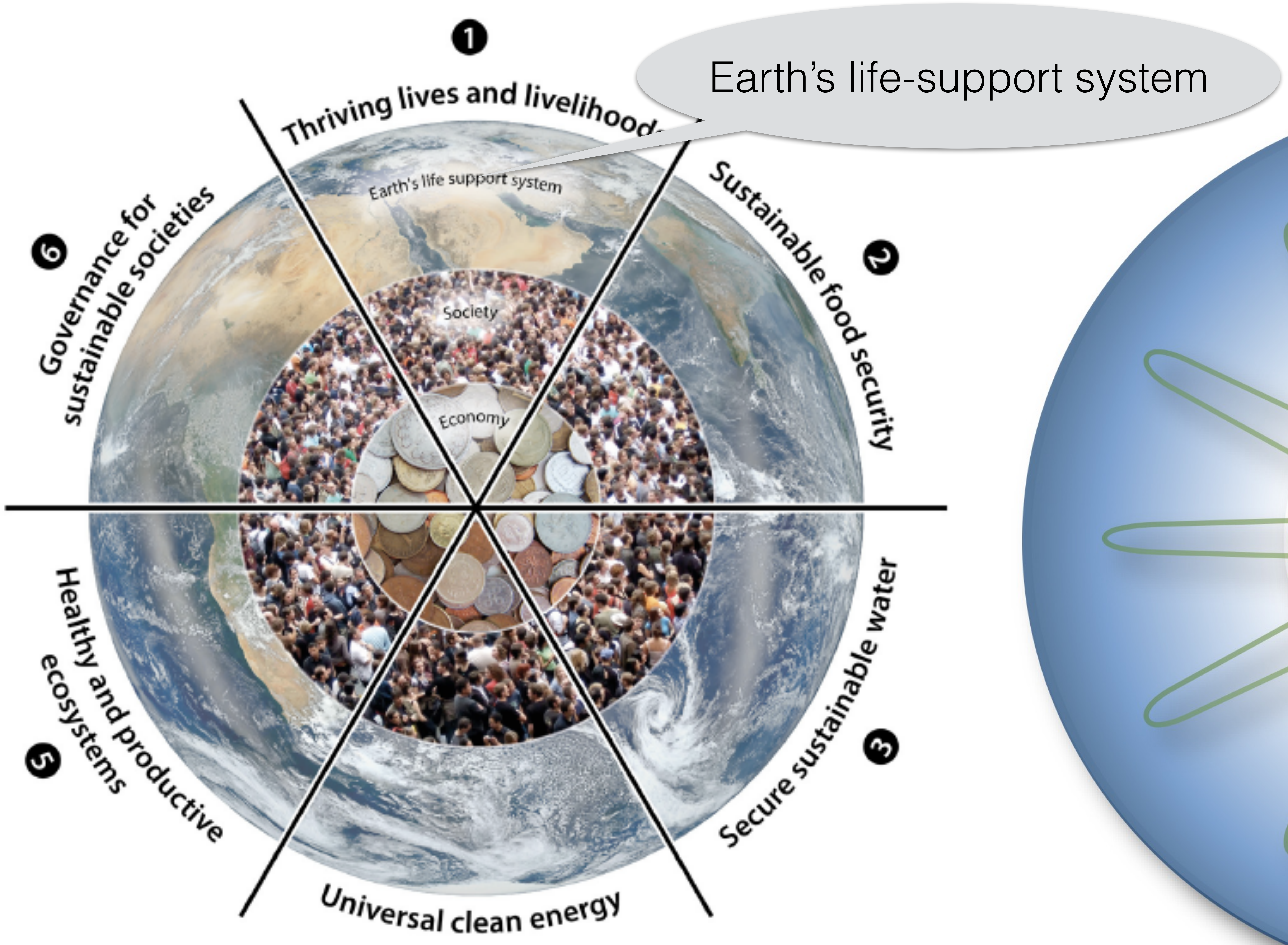


Griggs et al., 2013

Figure 1 | Six universal Sustainable Development Goals cutting across economic, social and environmental domains.

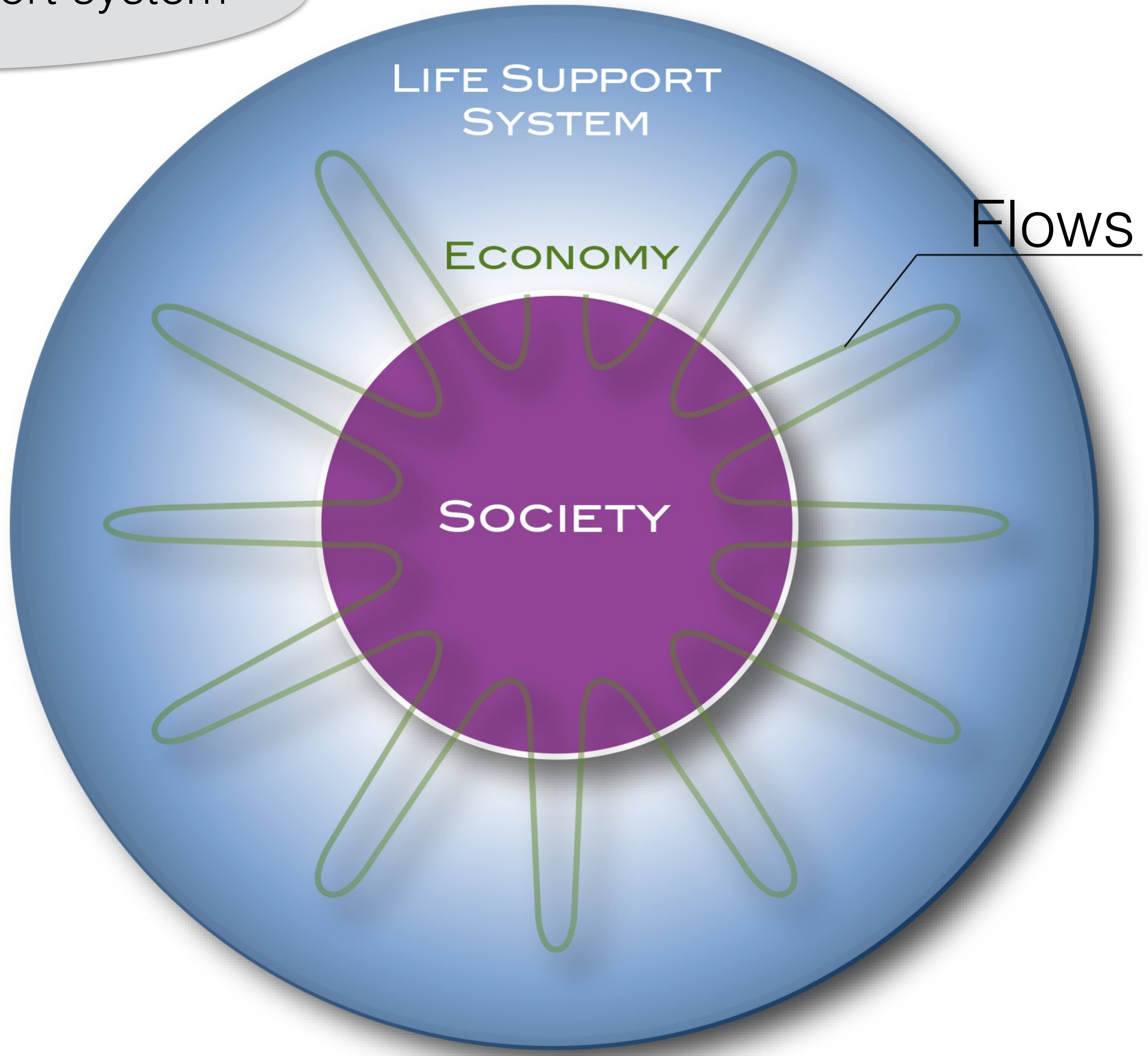
Jules-Plag and Plag, 2013

The Therapy: "Life-Style" Changes



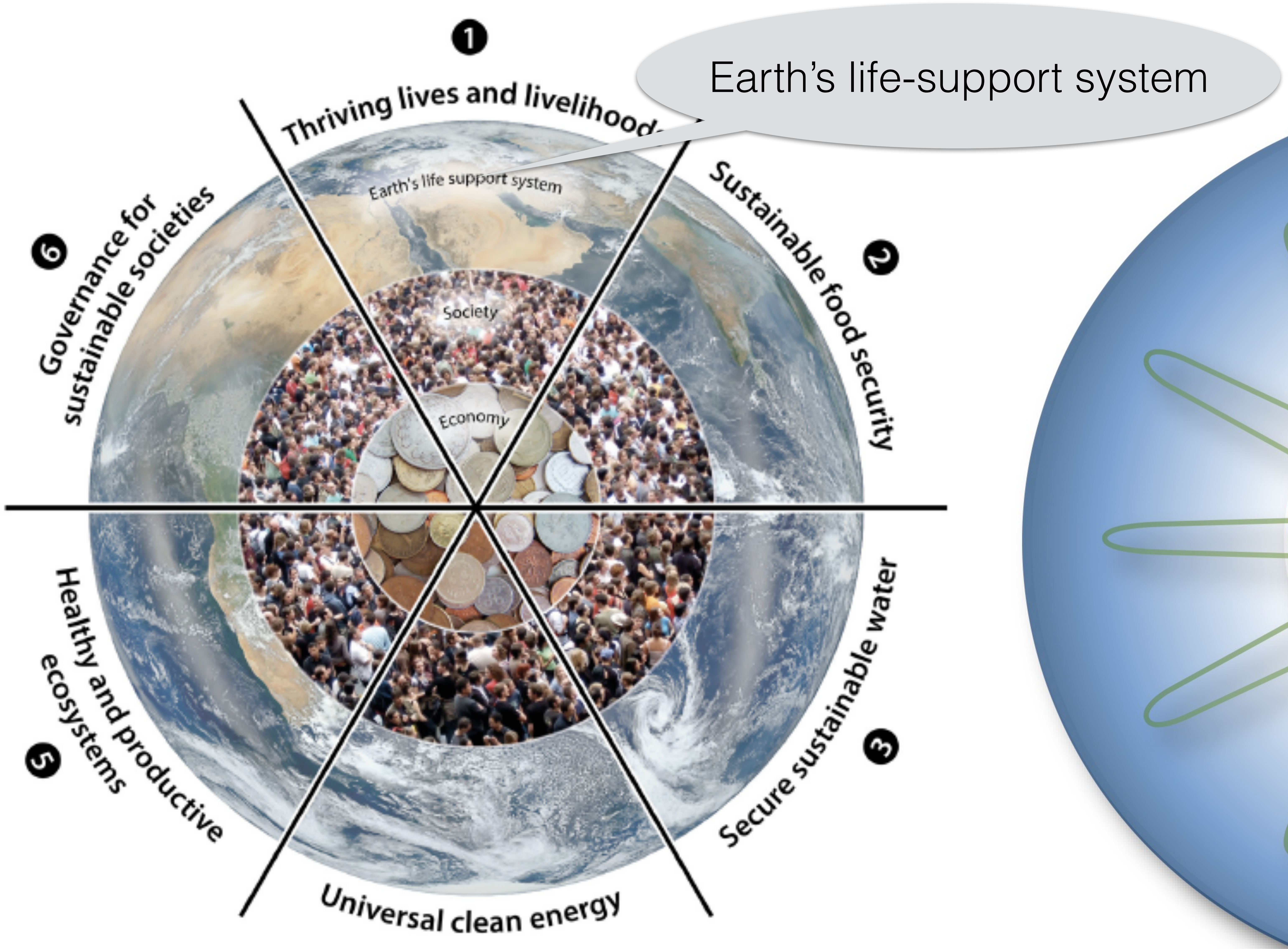
Griggs et al., 2013

Figure 1 | Six universal Sustainable Development Goals cutting across economic, social and environmental domains.



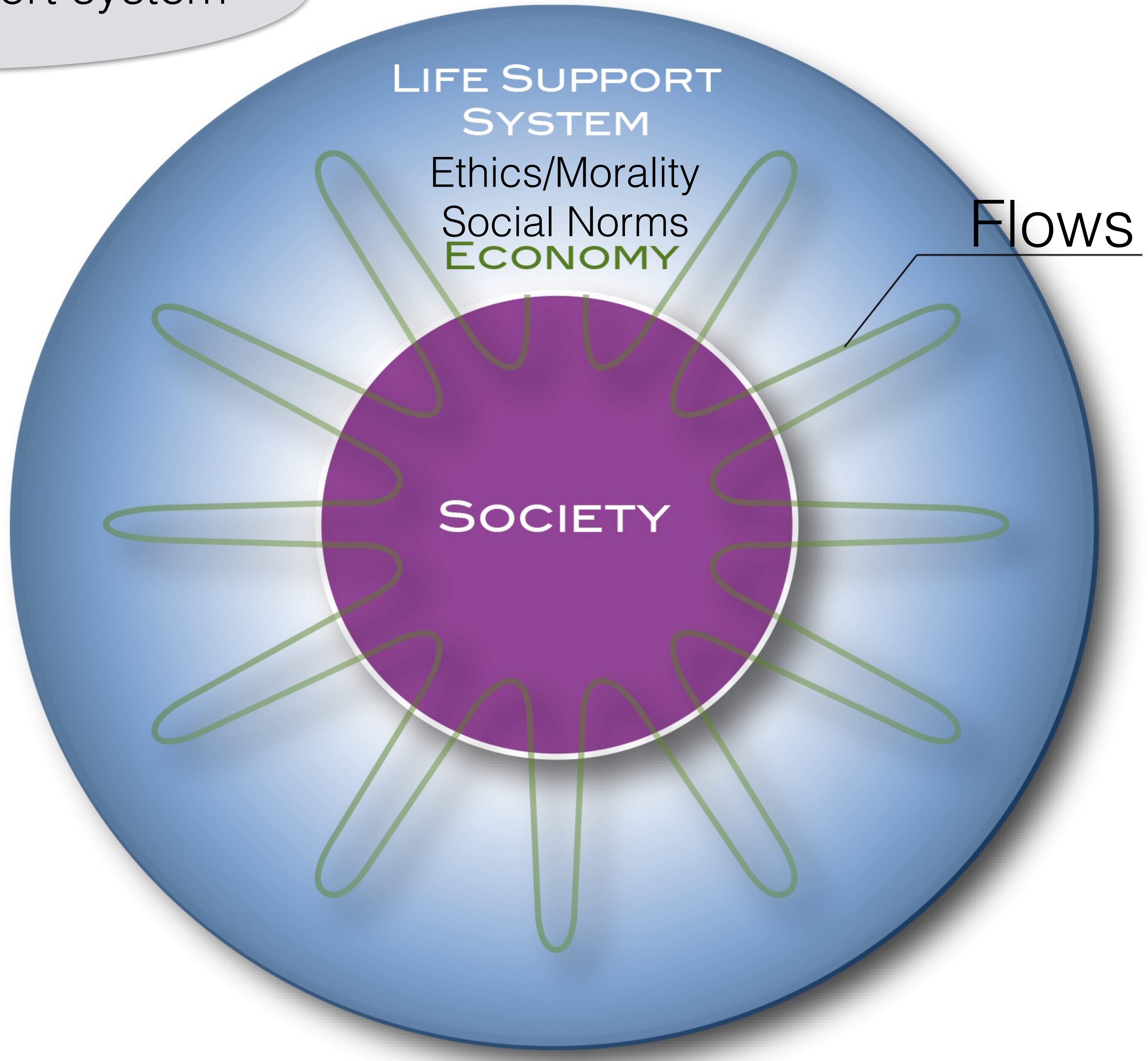
Jules-Plag and Plag, 2013

The Therapy: "Life-Style" Changes



Griggs et al., 2013

Figure 1 | Six universal Sustainable Development Goals cutting across economic, social and environmental domains.

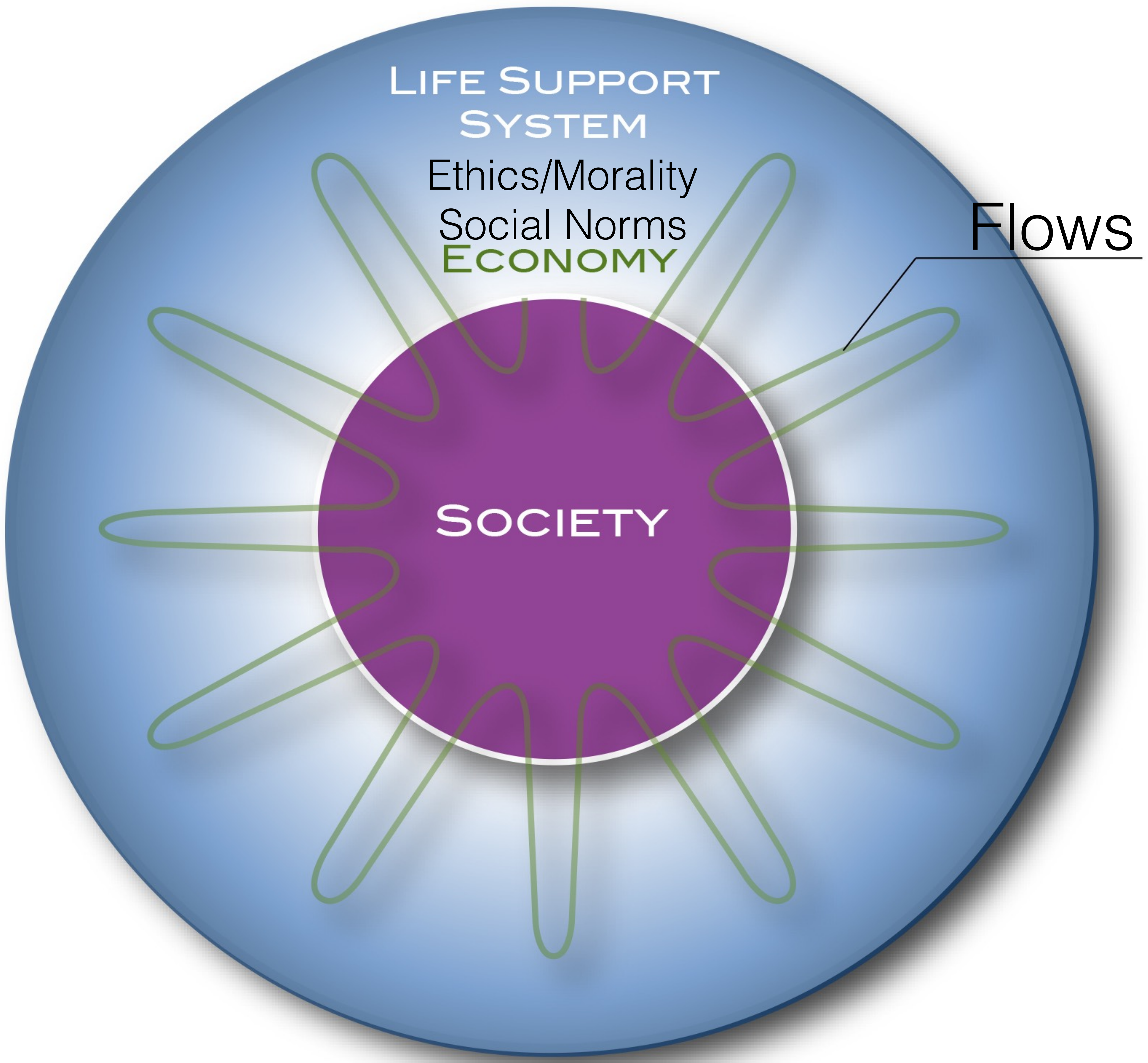


Jules-Plag and Plag, 2013

The Therapy: “Life-Style” Changes

“Sustainable Development is a development that meets the needs of the present while safeguarding Earth’s life support systems, on which the welfare of current and future generations depends.” (Griggs et al., 2013)

Our connection to the Earth’s Life-Support System is economic in nature: Economy controls the flows between the life-support system and us.



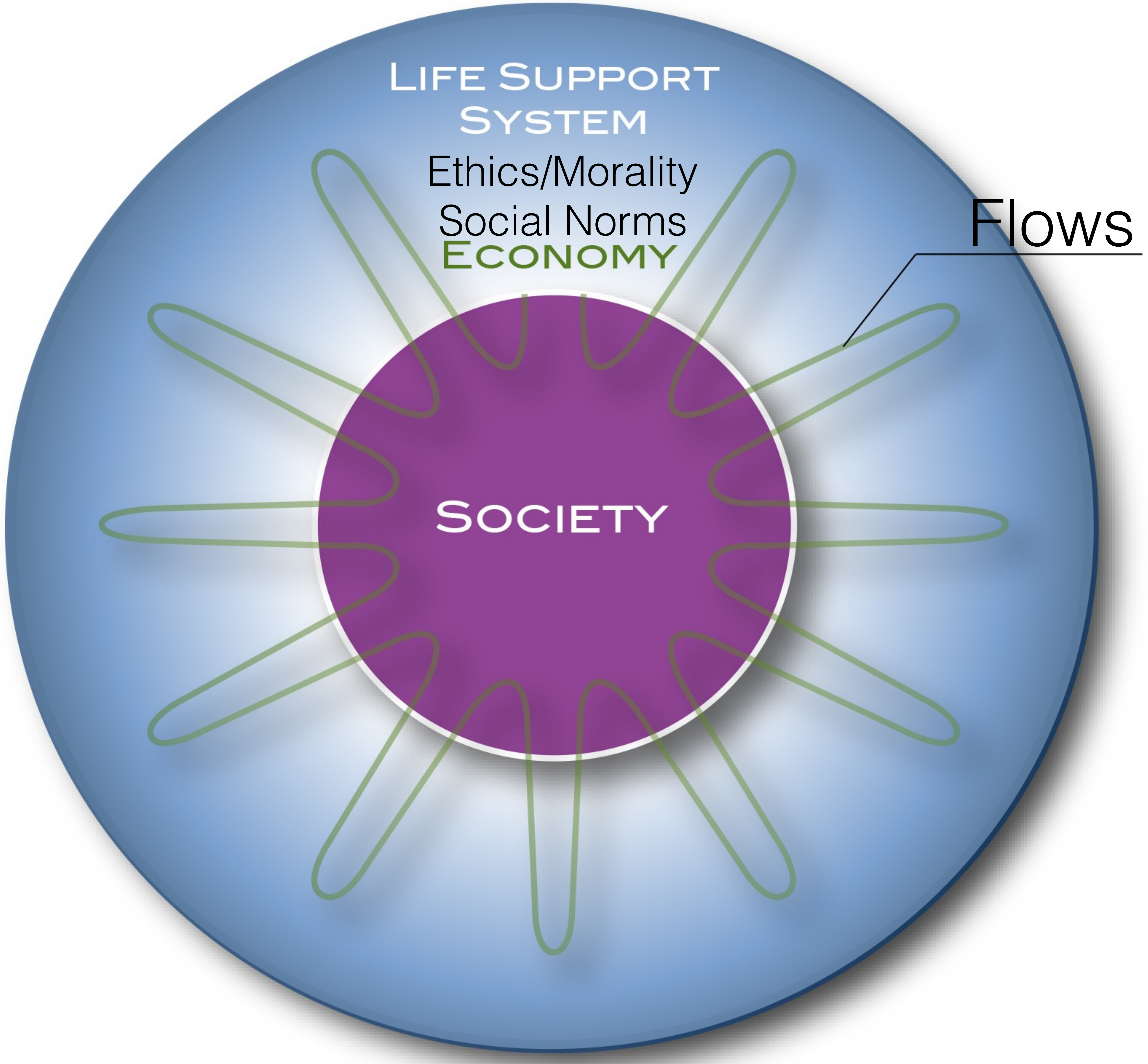
Jules-Plag and Plag, 2013

The Therapy: “Life-Style” Changes

“Sustainable Development is a development that meets the needs of the present while safeguarding Earth’s life support systems, on which the welfare of current and future generations depends.” (Griggs et al., 2013)

Our connection to the Earth’s Life-Support System is economic in nature: Economy controls the flows between the life-support system and us.

Economy for humanity:
“An economy that meets the needs of the present while safeguarding Earth’s life-support system, on which the welfare of current and future generations depends.”



Jules-Plag and Plag, 2013

The Therapy: “Life-Style” Changes

E4H
Economy 4 Humanity

Home · About Us · Contact Us · News · Events · Related · Follow Us · Email Us

THE PLEDGE | CERTIFICATION | SUSTAINABILITY | NETWORKING | TOOLS | USER ACCESS

Transition to an Economy for a Thriving Humanity

Home
The ELSS
Growth-Addicted Economy
Moral Economy

The Pledge
Certification
The Pledge Takers

Sustainability
Sustainable Development
SDGs

References

In 2017, Earth Overshoot Day was already reached on August 2, 2017.

The Pledge: I will carry out economic activities with the goal to meet the needs of the present while safeguarding Earth's life-support systems, on which the welfare of current and future generations depends.

Our Vision: Facilitating the great transition from the present “Economy Against Humanity” to an “Economy for Humanity” that “meets the needs of the present while safeguarding Earth's life-support system, on which the welfare of current and future generations depends.”

“Somehow, we have come to think the whole purpose of the economy is to grow, yet growth is not a goal or purpose. The pursuit of endless growth is suicidal.” David Suzuki

The Therapy: “Life-Style” Changes

E4H Economy 4 Humanity

Home · About Us · Contact Us · News · Events · Related · Follow Us · Email Us

THE PLEDGE · CERTIFICATION · SUSTAINABILITY · NETWORKING · TOOLS · USER ACCESS

Transition to an Economy for a Thriving Humanity

Home
The ELSS
Growth-Addicted Economy
Moral Economy

The Pledge
Certification
The Pledge Takers

Sustainability
Sustainable Development
SDGs

References

In 2017, Earth Overshoot Day was already reached on August 2, 2017.

The Pledge: I will carry out economic activities with the goal to meet the needs of the present while safeguarding Earth's life-support systems, on which the welfare of current and future generations depends.

Our Vision: Facilitating the great transition from the present "Economy Against Humanity" to an "Economy for Humanity" that "meets the needs of the present while safeguarding Earth's life-support system, on which the welfare of current and future generations depends."

"Somehow, we have come to think the whole purpose of the economy is to grow, yet growth is not a goal or purpose. The pursuit of endless growth is suicidal." David Suzuki

Transition towards an economy that “meets the needs of the present, while safe-guarding the Earth’s life-support system, on which the welfare of current and future generations (of human and non-human animals) depends.”

Key Points

Baseline

During the Holocene, climate and sea level were exceptionally stable

The Holocene was a "safe operating space for humanity"

Syndrome

During the last hundred years, humanity has introduced rapid and large changes

The system is outside the "normal range" and in the dynamic transition into the Post-Holocene; we have increasing disequilibrium

Diagnosis

Easy access to seemingly unlimited energy allowed humans to accelerate flows in the Earth's life-support system and sustain rapid population growth and increasing demands

Humans are the "Anthropogenic Cataclysmic Virus" (ACV) in the Earth's life-support system

Prognosis

We are heading rapidly into a very different system state (thresholds; Post-Holocene)

Our knowledge is changing rapidly; there is room for surprises; Foresight is needed

Therapy

Change in the purpose of economy from growing human wealth (growth addiction) to "meeting our needs while safe-guarding the life-support system"


"No problem can be solved with the same consciousness that created it."
Albert Einstein
"It is difficult to get a man to understand something when his job depends on not understanding it"
Upton Sinclair

Natural Hazards and Disaster

Class 27: Climate Change Impacts

- Sea Level Rise
- Heat Waves
- Droughts
- Cold Spells
- Wildfires

Natural Hazards and Disaster

Class 27: Climate Change Impacts

- Sea Level Rise
- Heat Waves
- Droughts
- Cold Spells
- Wildfires

Sea Level Rise

Longer-term:

- $1^{o}C$ corresponds to about 25 m in sea level
- Expect large sea level rise over several centuries (several meters to >20 m)
- Horizontal migration of coasts
- Pollution of inundated coastal areas and waters
- Prepare for loss of coastal cities

Longer-term:

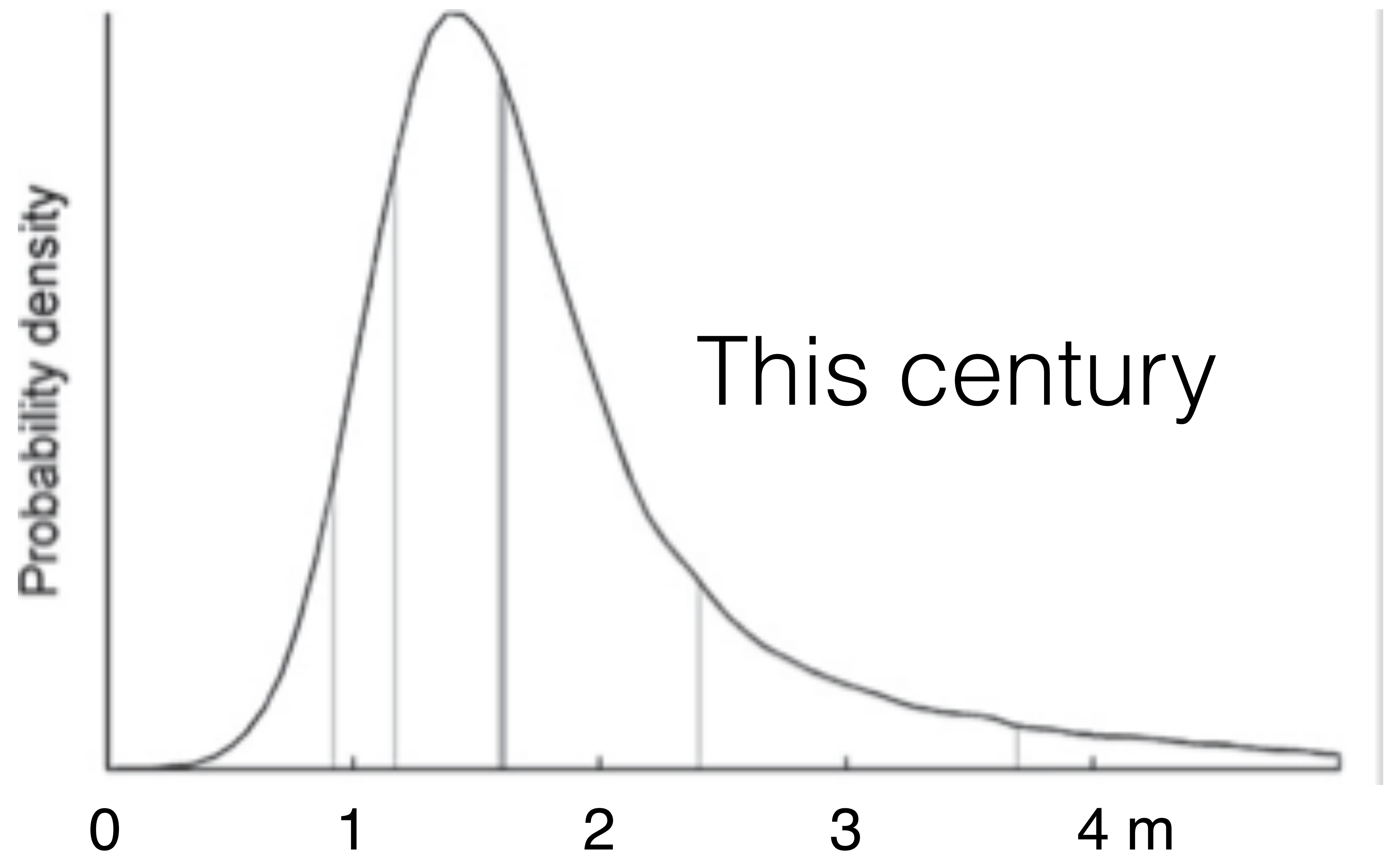
- $1^{o}C$ corresponds to about 25 m in sea level
- Expect large sea level rise over several centuries (several meters to >20 m)
- Horizontal migration of coasts
- Pollution of inundated coastal areas and waters
- Prepare for loss of coastal cities

We have committed to an ice-free planet: eventually 65 m (195 ft) of sea level rise (1000 - 5000 years)

Longer-term:

- 1^{o}C corresponds to about 25 m in sea level
- Expect large sea level rise over several centuries (several meters to >20 m)
- Horizontal migration of coasts
- Pollution of inundated coastal areas and waters
- Prepare for loss of coastal cities

We have committed to an ice-free planet: eventually 65 m (195 ft) of sea level rise (1000 - 5000 years)

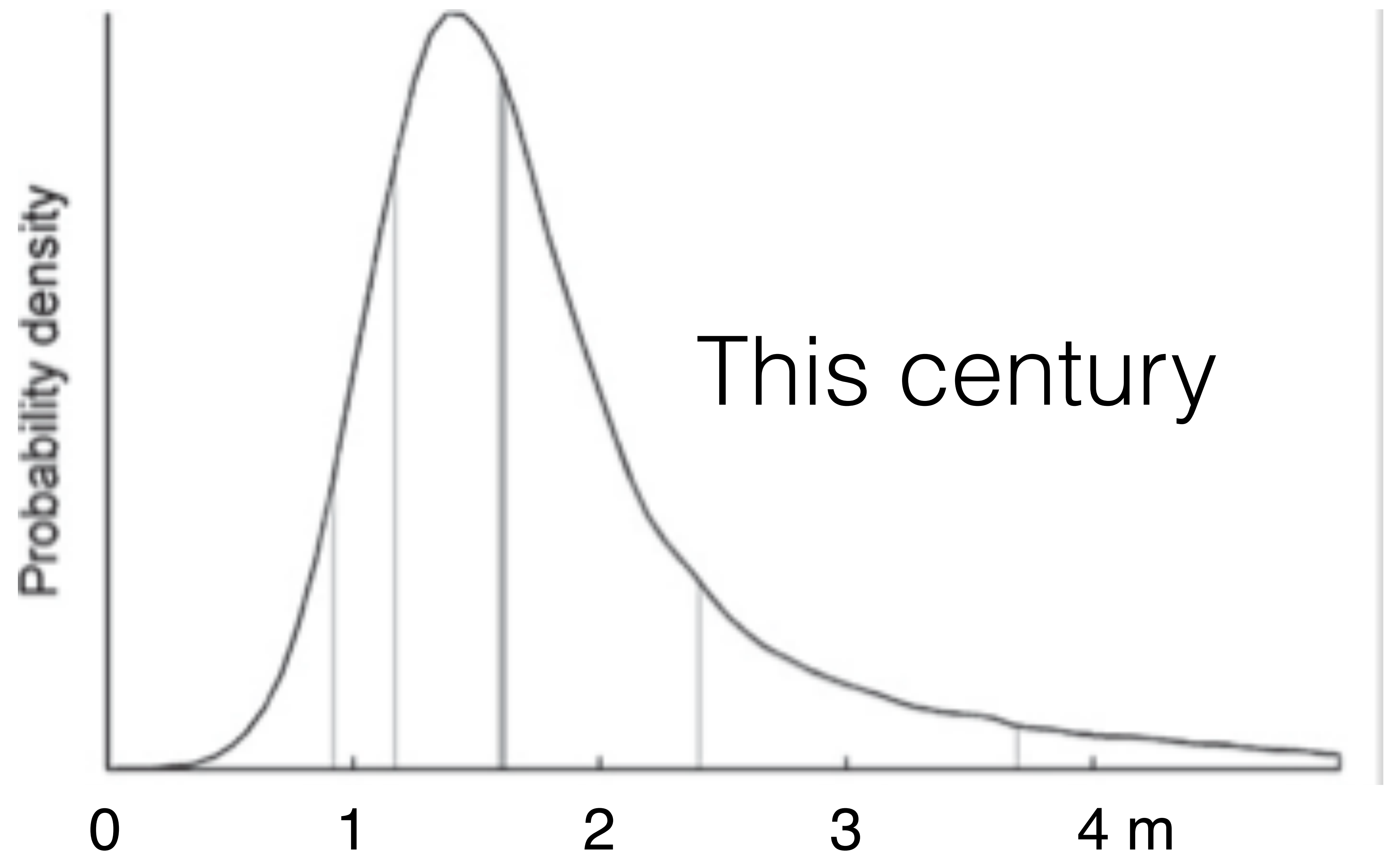


Sea Level Rise

Longer-term:

- 1^oC corresponds to about 25 m in sea level
- Expect large sea level rise over several centuries (several meters to >20 m)
- Horizontal migration of coasts
- Pollution of inundated coastal areas and waters
- Prepare for loss of coastal cities

Eventually, protections will fail

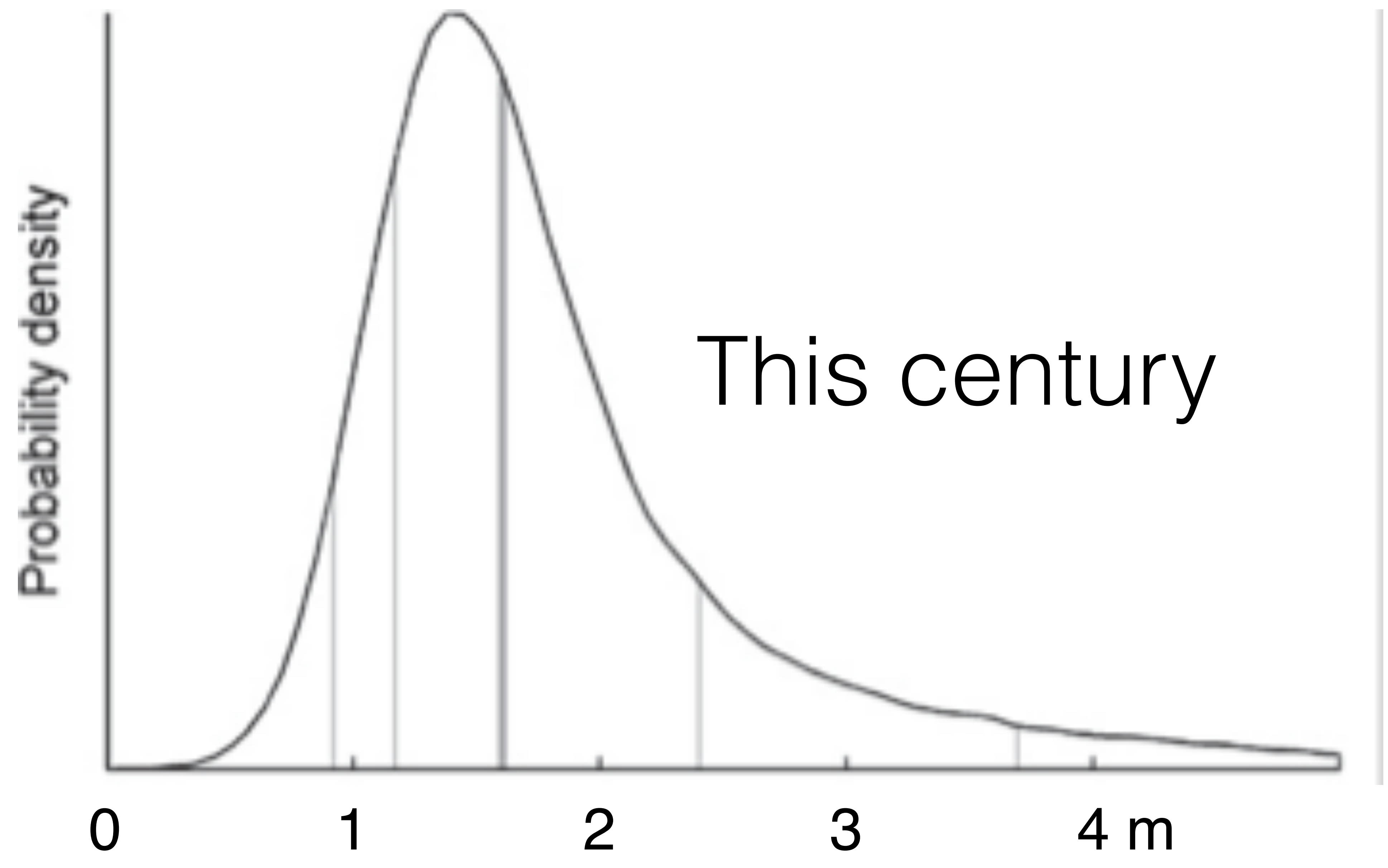


Sea Level Rise

Longer-term:

- 1^{o}C corresponds to about 25 m in sea level
- Expect large sea level rise over several centuries (several meters to >20 m)
- Horizontal migration of coasts
- Pollution of inundated coastal areas and waters
- Prepare for loss of coastal cities

Slowly divest in exposed coastal areas

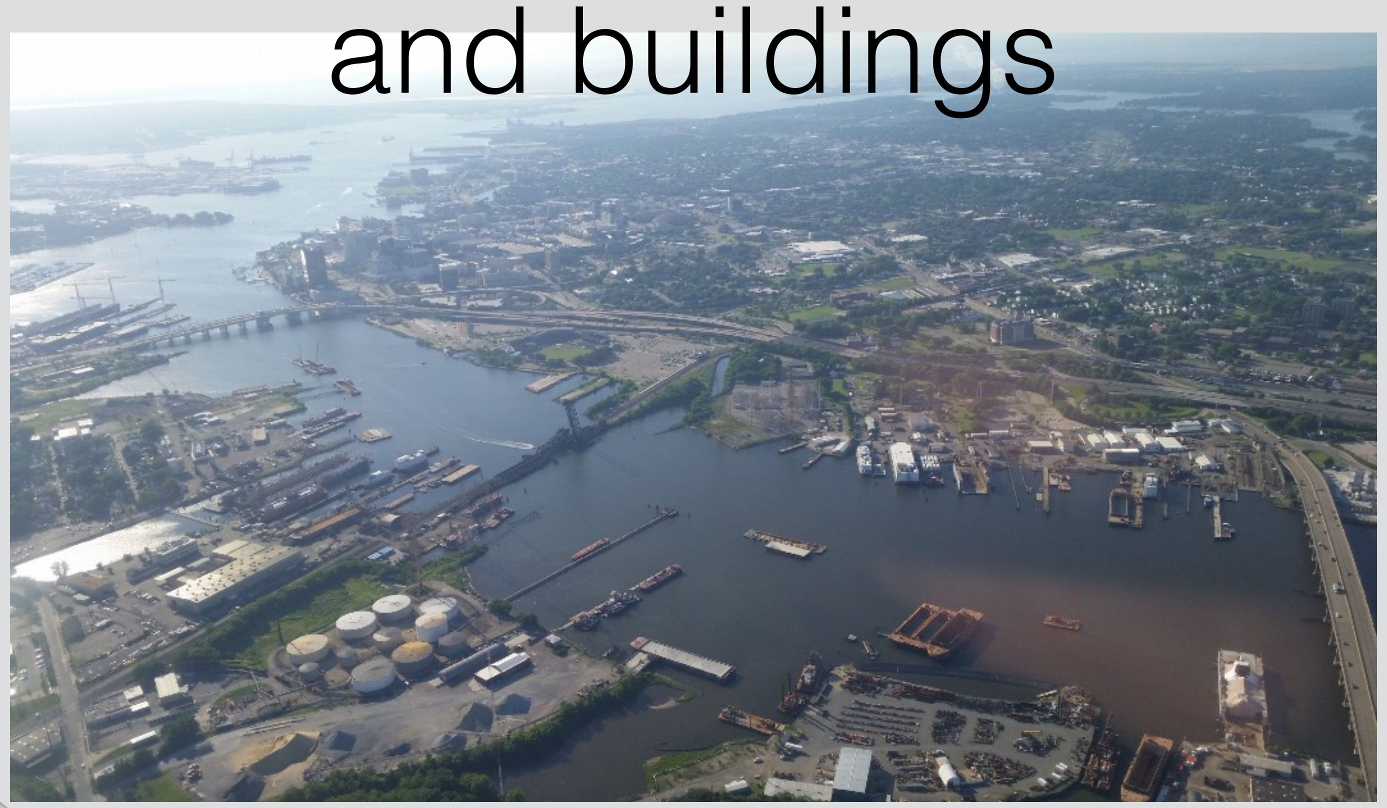


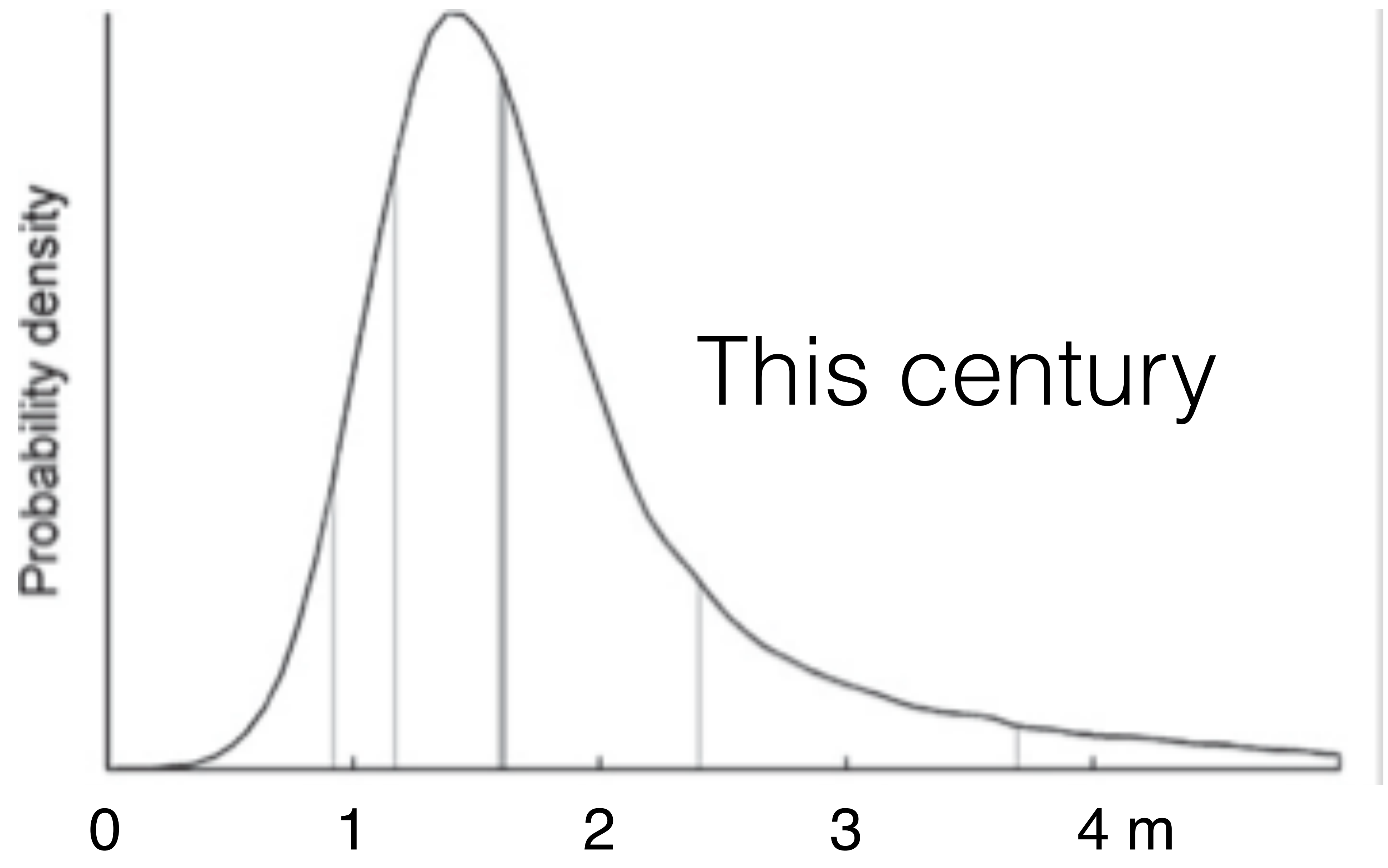
Sea Level Rise

Longer-term:

- 1^{o}C corresponds to about 25 m in sea level
- Expect large sea level rise over several centuries (several meters to >20 m)
- Horizontal migration of coasts
- Pollution of inundated coastal areas and waters
- Prepare for loss of coastal cities

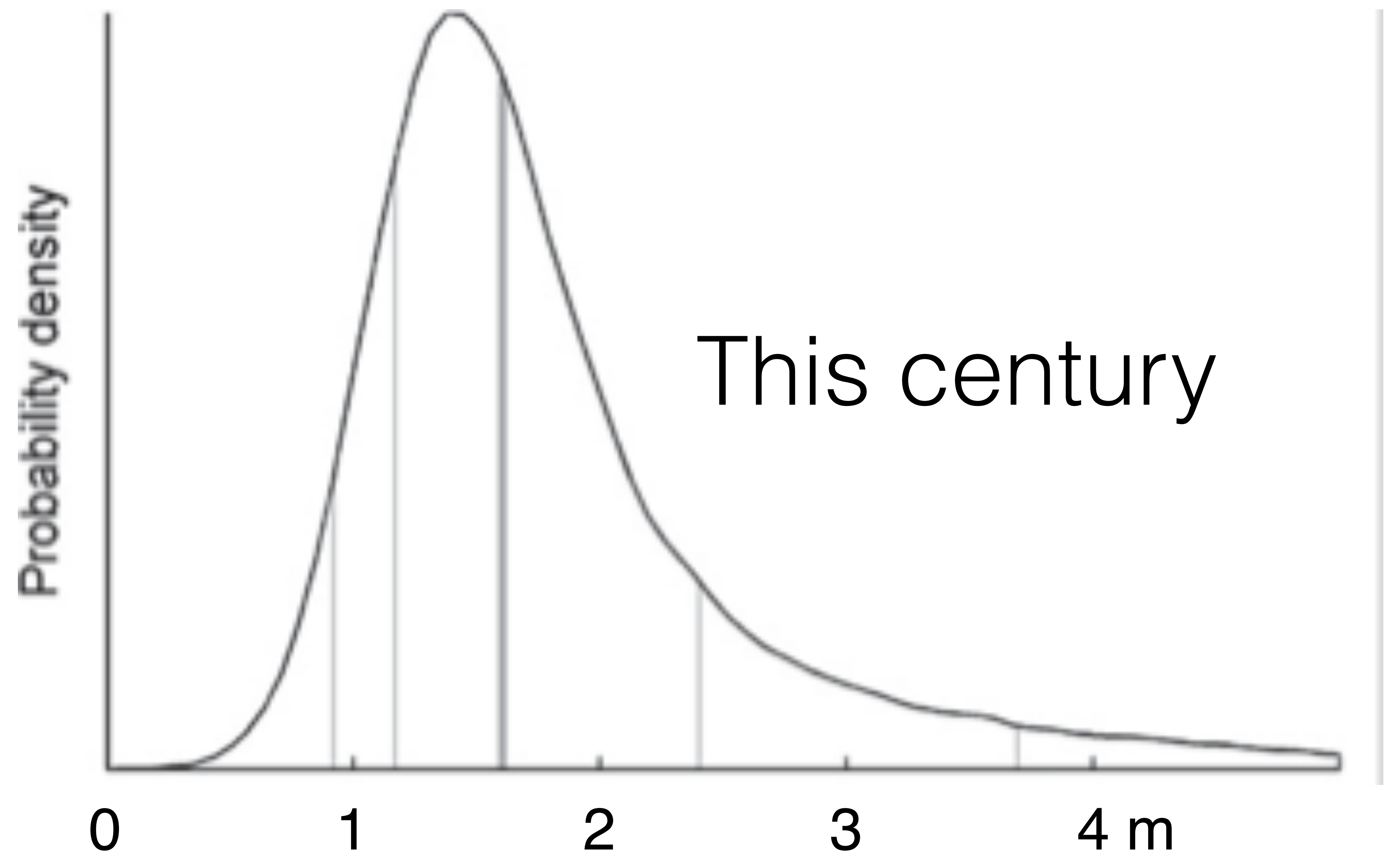
Build mobile infrastructure and buildings





Longer-term:

- $1^{o}C$ corresponds to about 25 m in sea level
- Expect large sea level rise over several centuries (several meters to >20 m)
- Horizontal migration of coasts
- Pollution of inundated coastal areas and waters
- Prepare for loss of coastal cities

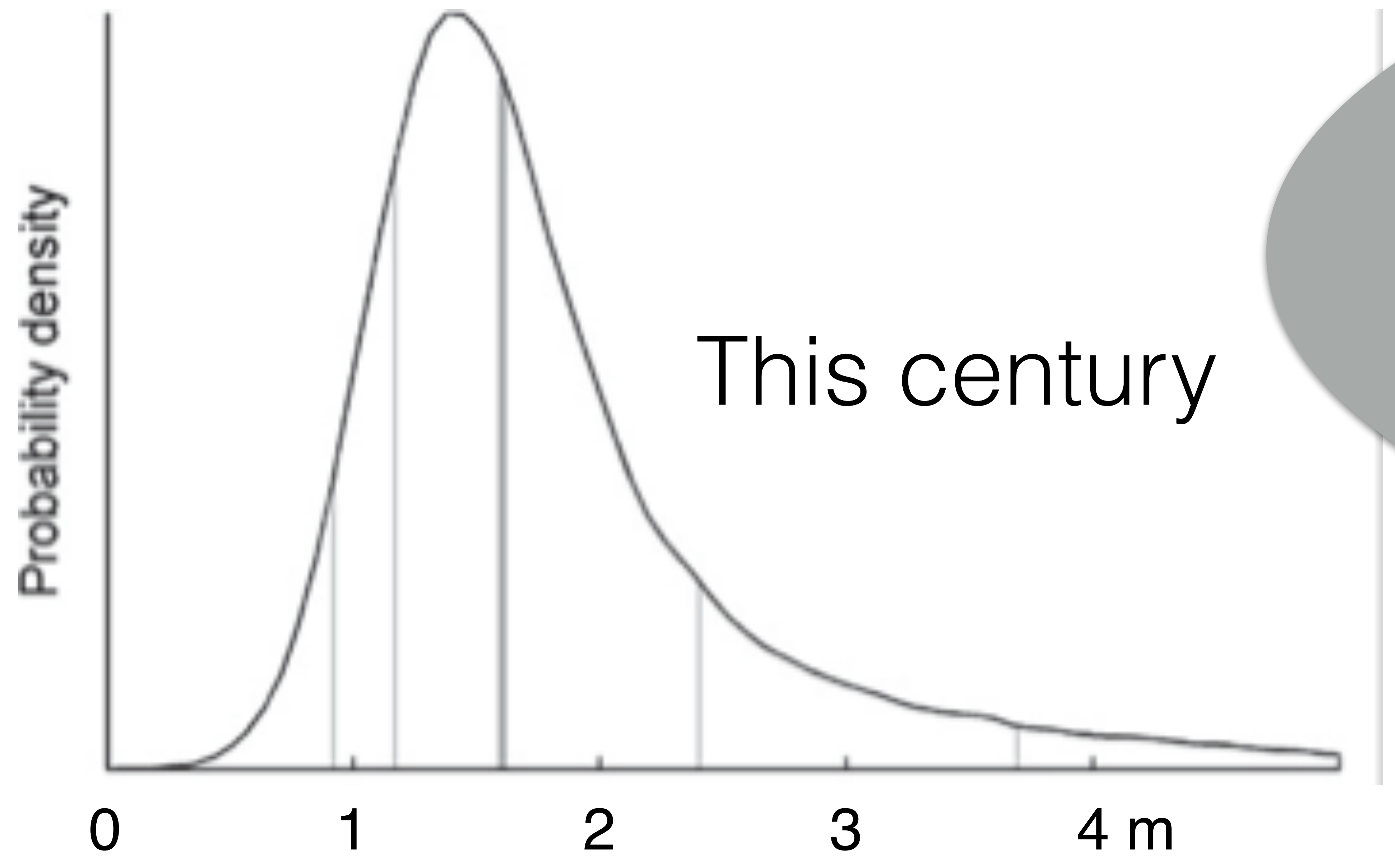


Clean up the coastal zone

Sea Level Rise

Longer-term:

- 1°C corresponds to about 25 m in sea level
- Expect large sea level rise over several centuries (several meters to >20 m)
- Horizontal migration of coasts
- Pollution of inundated coastal areas and waters
- Prepare for loss of coastal cities



Will a rising tide sink all homes?

Zillow

Nationwide, almost 1.9 million homes (or roughly 2 percent of all U.S. homes) worth a combined $882 billion are at risk of being underwater by 2100 if sea levels rise by six feet. Some states will be hit harder than others.

State	Number of Potentially Underwater Properties	Fraction of Total Housing Stock Underwater	Total Value of Potentially Underwater Properties
California	42,353	0.44%	$49.2B
Texas	46,804	0.61%	$12B
New York	96,708	2.10%	$71B
Florida	934,411	12.56%	$413B
Pennsylvania	2,661	0.06%	$730M
Georgia	24,379	0.75%	$10.2B
North Carolina	[illegible]	[illegible]	$20.6B
New [illegible]	[illegible]	[illegible]	[illegible]
Maine	[illegible]	[illegible]	[illegible].1B
New Hampshire	4,064	0.71%	$1.7B
Rhode Island	4,853	1.47%	$2.9B
Delaware	11,670	3.09%	$3.6B

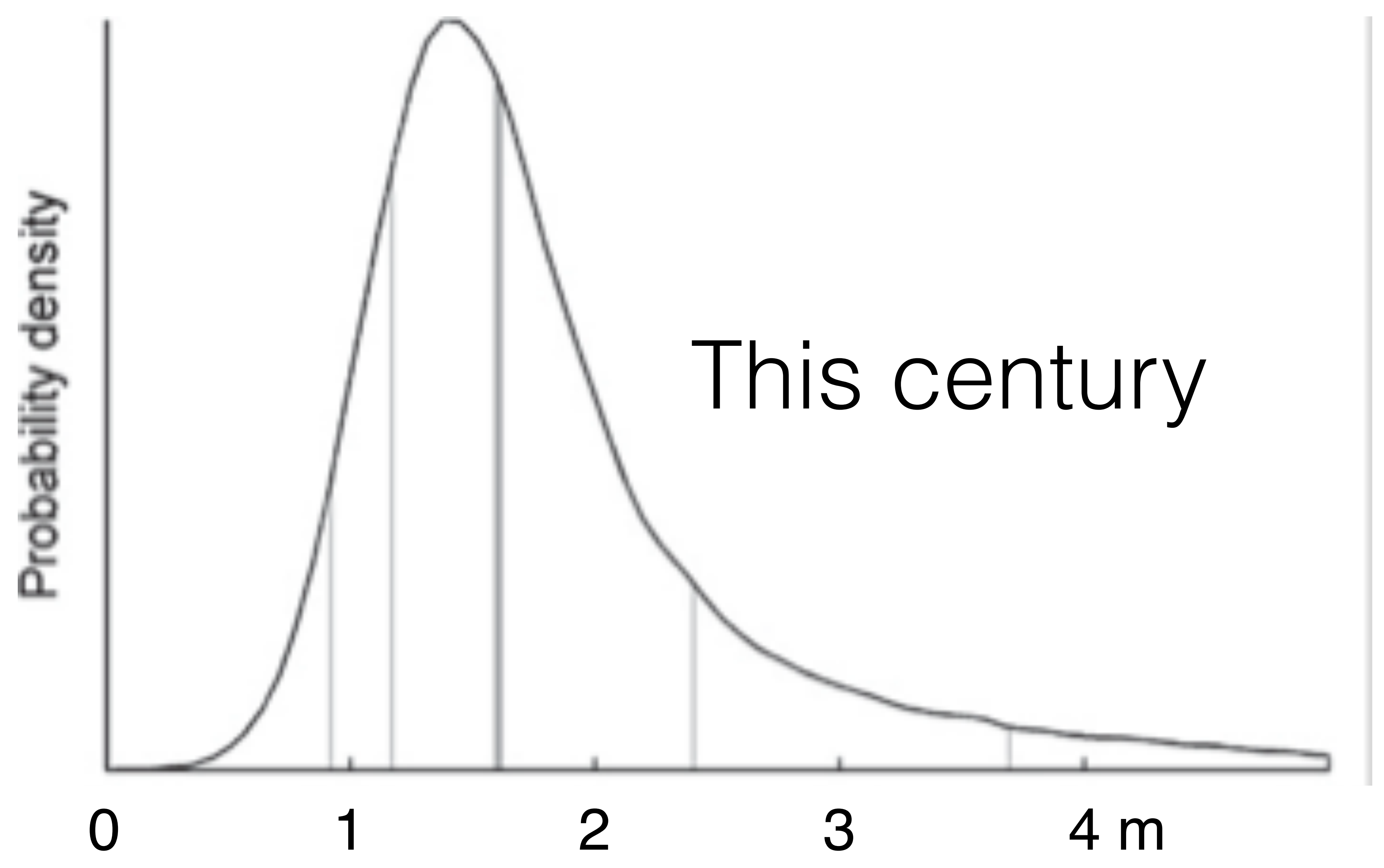
Source: National Oceanic and Atmospheric Administration (NOAA); Zillow data

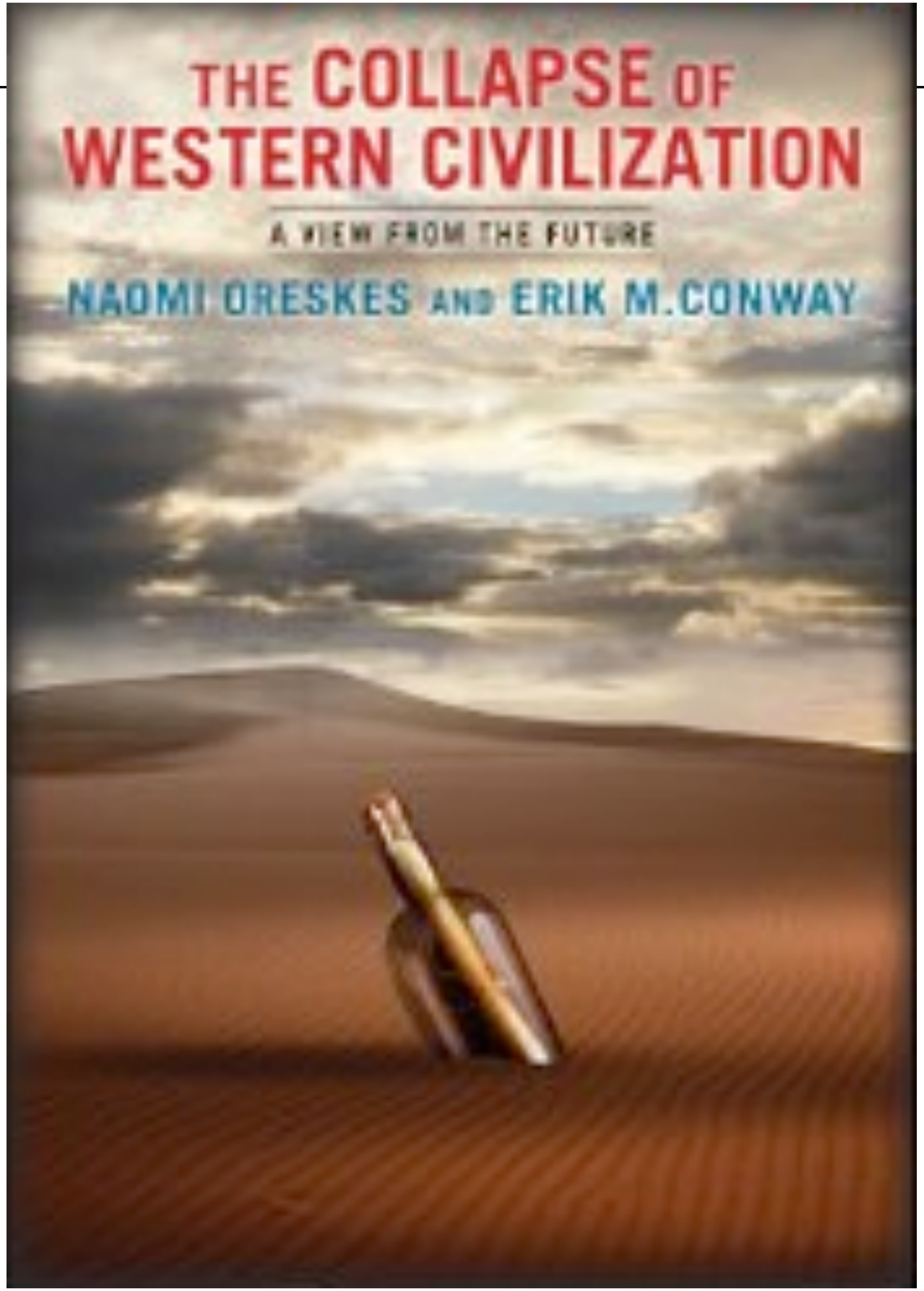
Zillow study:

- 1.8 m by 2100
- 36 U.S. Coastal Cities lost;
- more than 50 cities lose at least 50% of residential real estate
- $1 Trillion in loss (2% of residential real estate value)

Longer-term:

- $1^{o}C$ corresponds to about 25 m in sea level
- Expect large sea level rise over several centuries (several meters to >20 m)
- Horizontal migration of coasts
- Pollution of inundated coastal areas and waters
- Prepare for loss of coastal cities





Sea Level Rise

Sea Level Rise

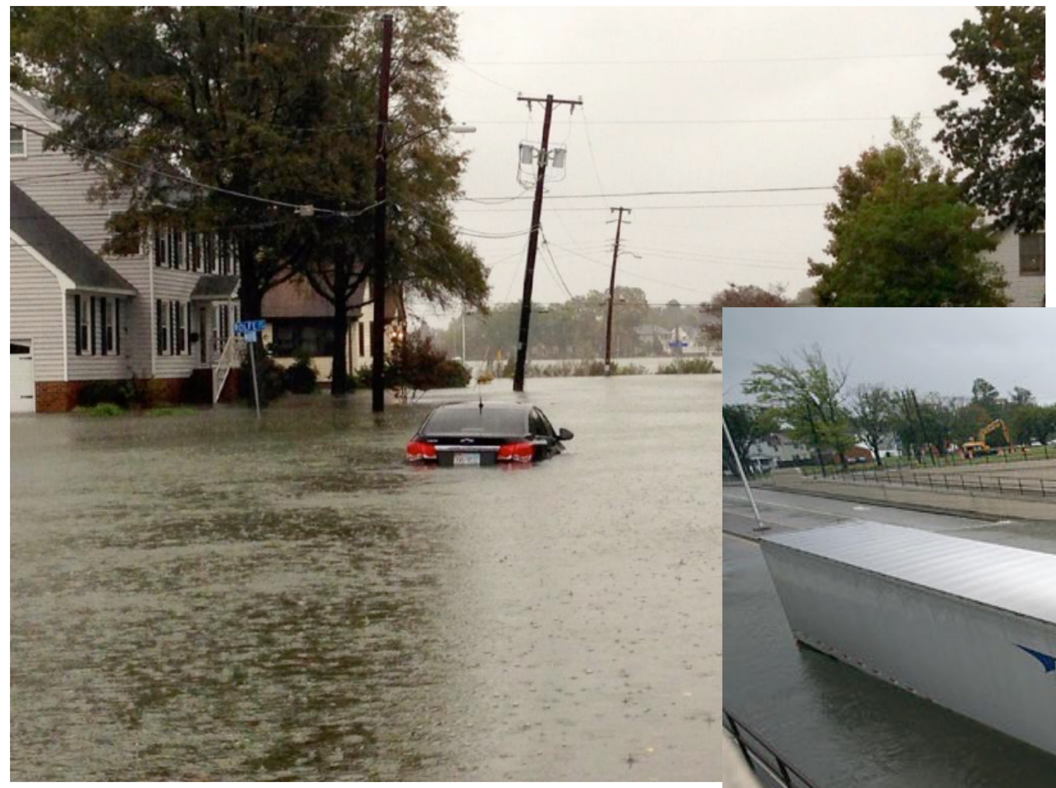
Example Hampton Roads

Today: 5 mm/year
(~ 50 cm/century)

Sea Level Rise

Example Hampton Roads

Today: 5 mm/year
(~ 50 cm/century)



Soon could get as high as:
20 mm/year (2 m/century)

Sea Level Rise

Example Ha

Today: 5 mm

(~ 50 cm/cen

Soon could get as high as:
20 mm/year (2 m/century)

Local Sea Level Rise leads to:
- more nuisance flooding
- higher risk of extreme floods
- a transient coast line

Sea Level Rise

October 2, 2015

Example Ha

Today: 5 mm

(~ 50 cm/cen

Soon could get as high as:
20 mm/year (2 m/century)

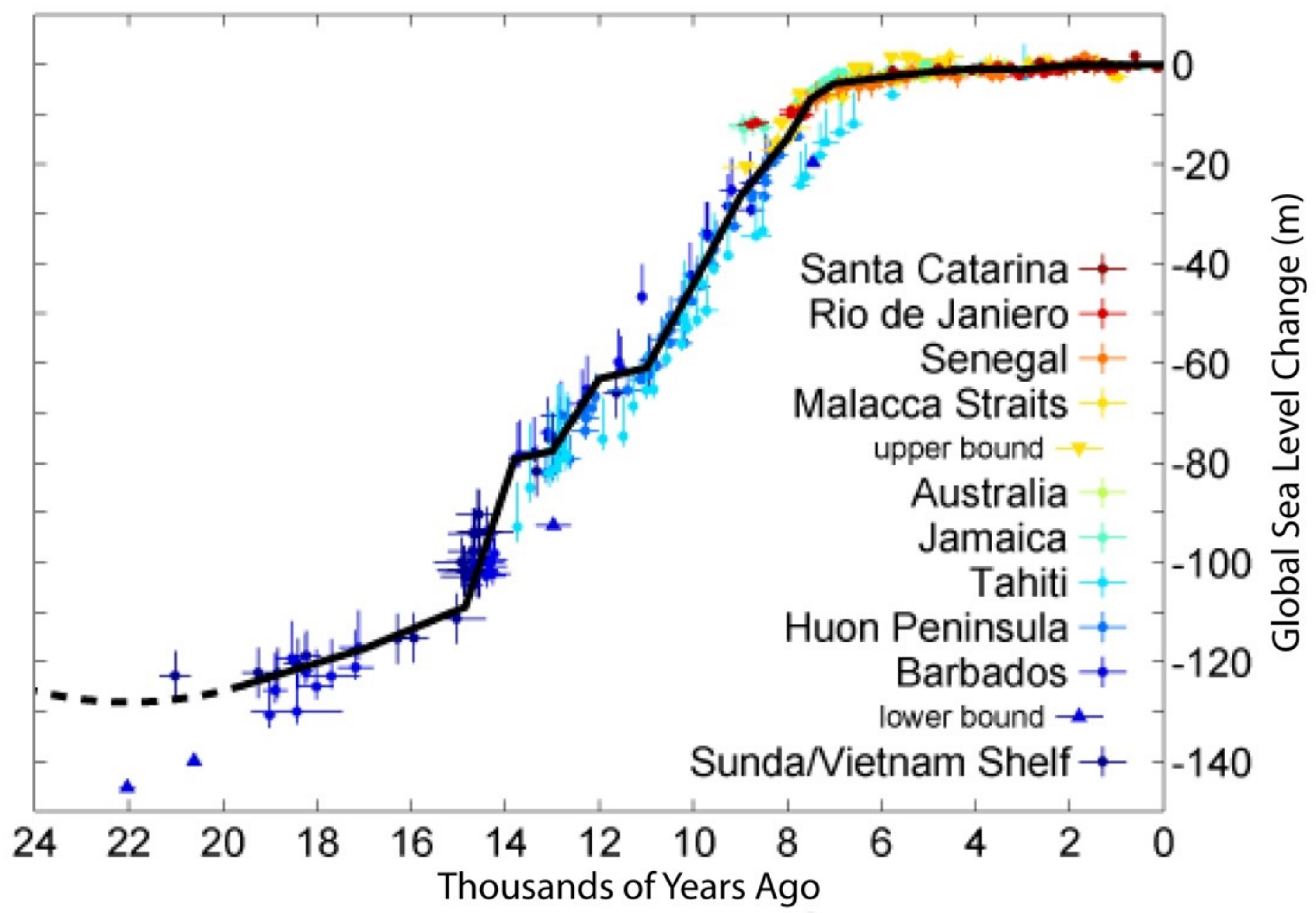
Local Sea Level Rise leads to:
- more nuisance flooding
- higher risk of extreme floods
- a transient coast line

Future Sea Level Rise

Future Sea Level Rise

Question: What is the probability density function for sea level change per century?

Sea Level Rise

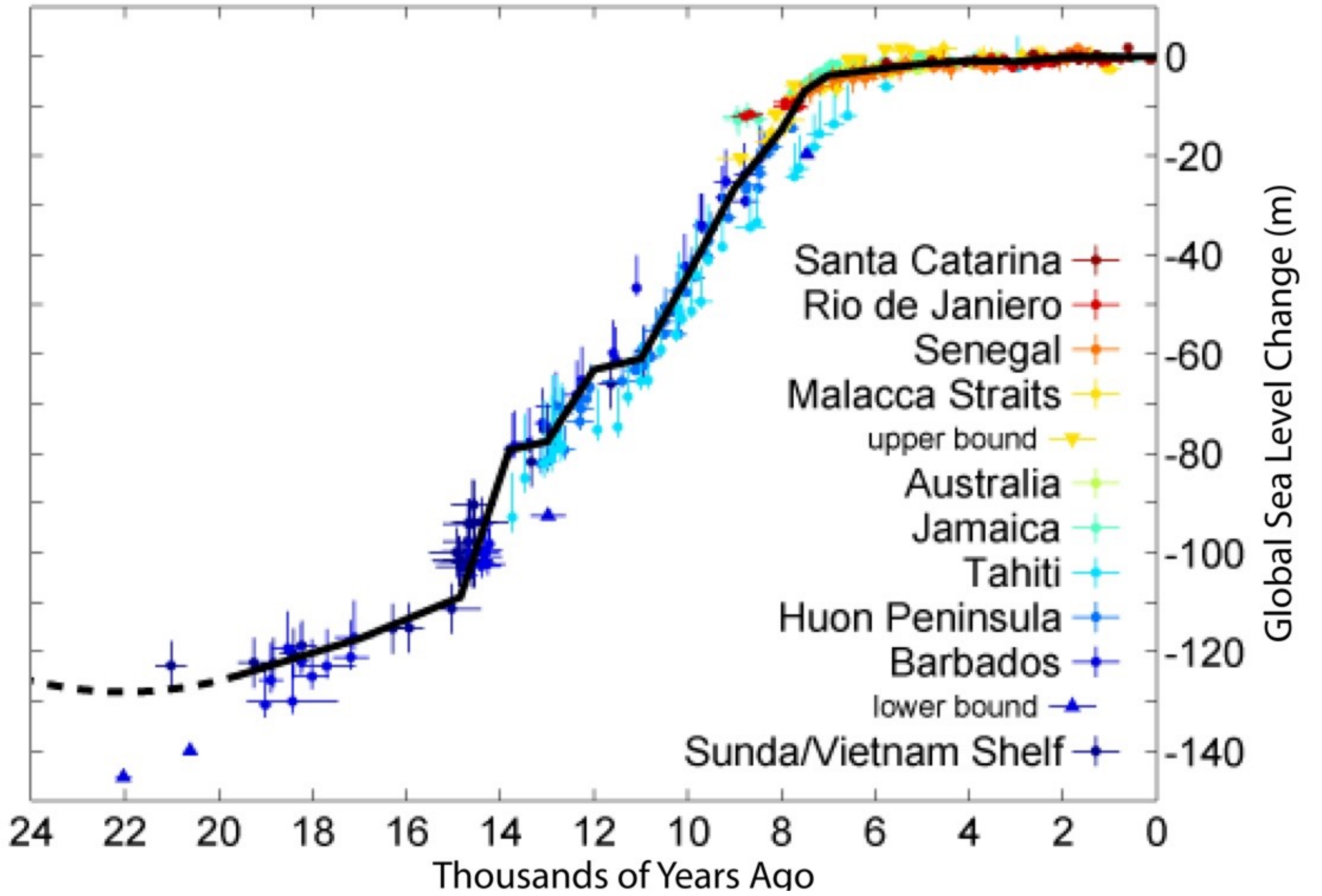


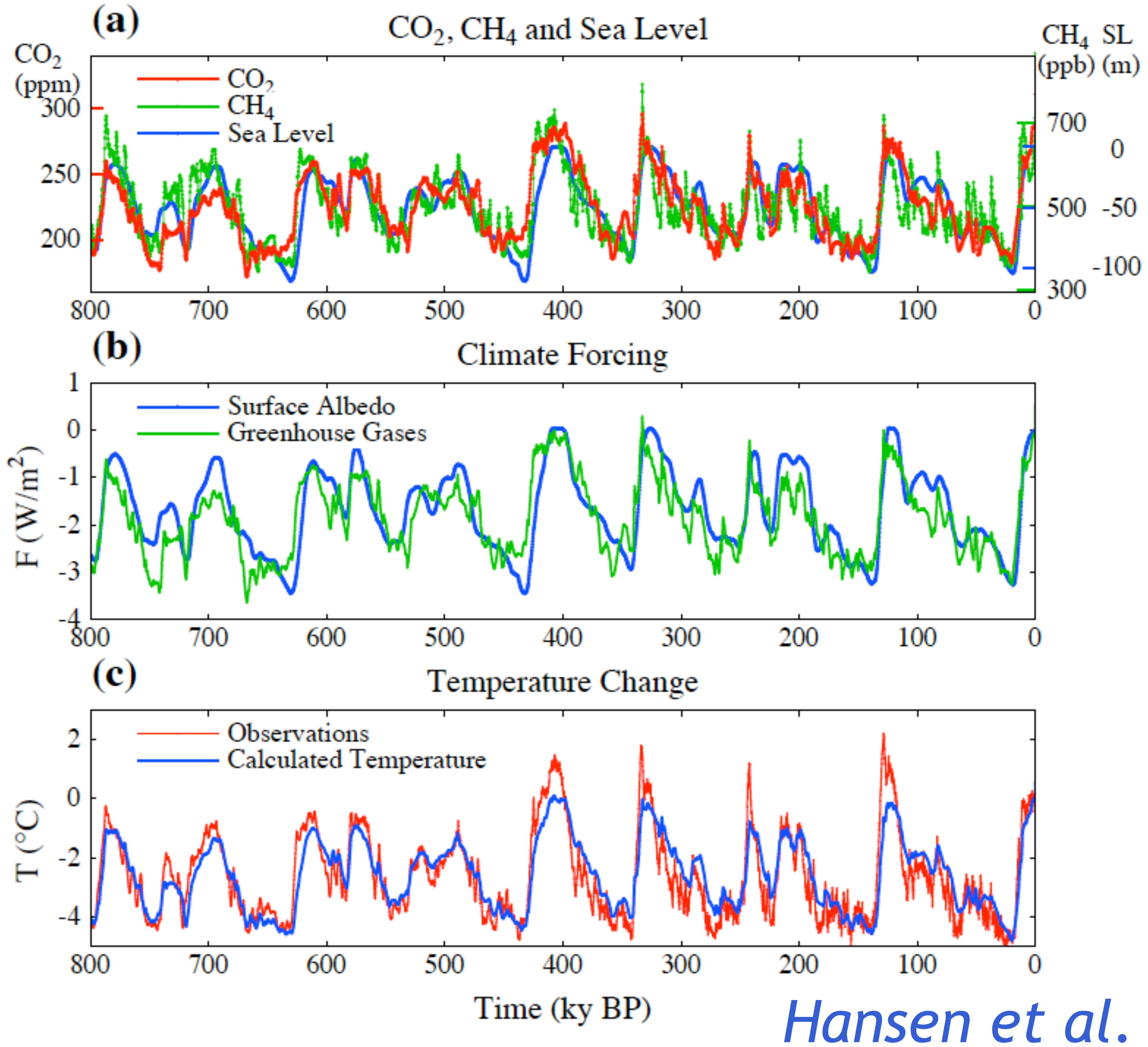
Future Sea Level Rise

Question: What is the probability density function for sea level change per century?

Look at paleo-data …

Sea Level Rise





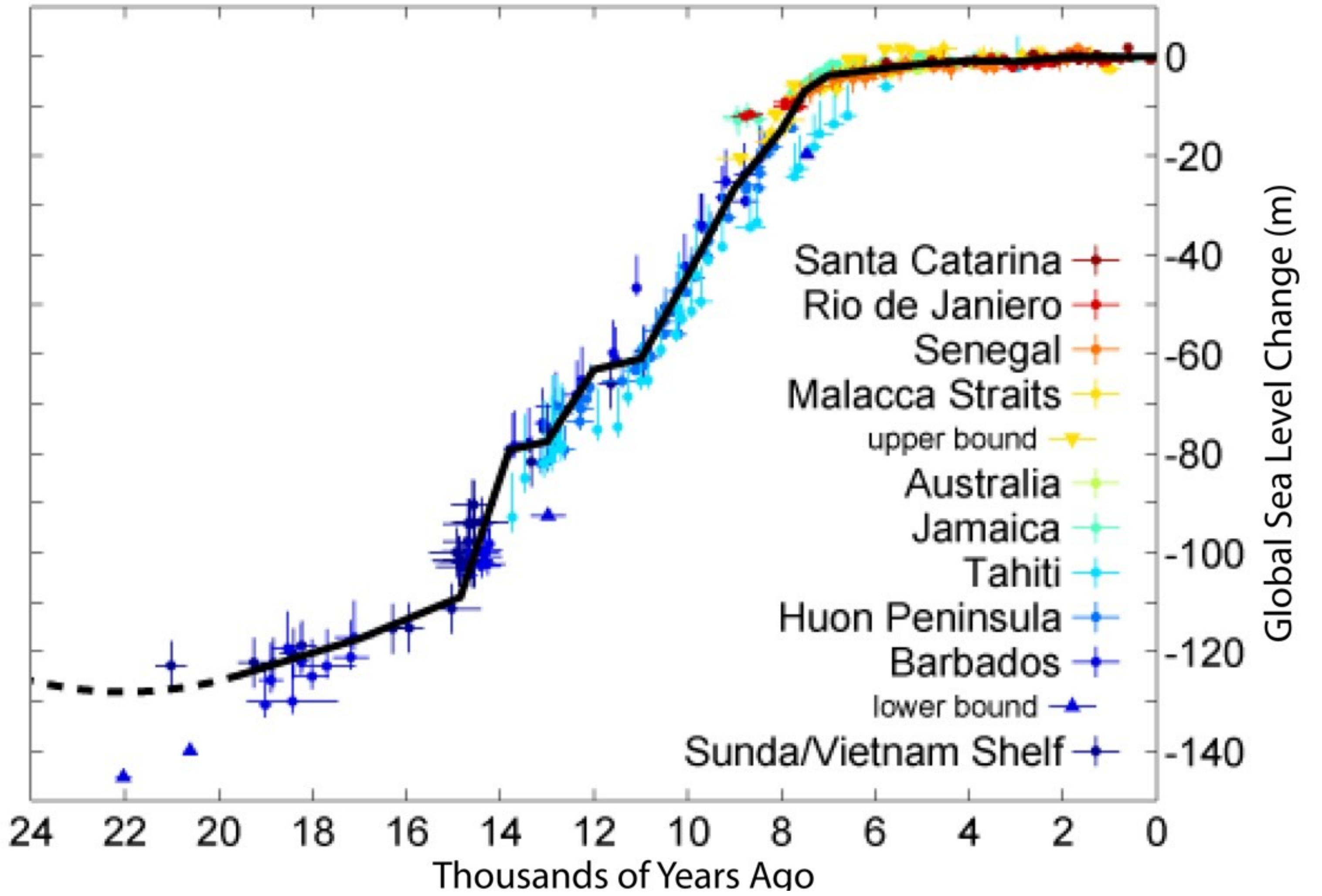
Hansen et al. (2008)

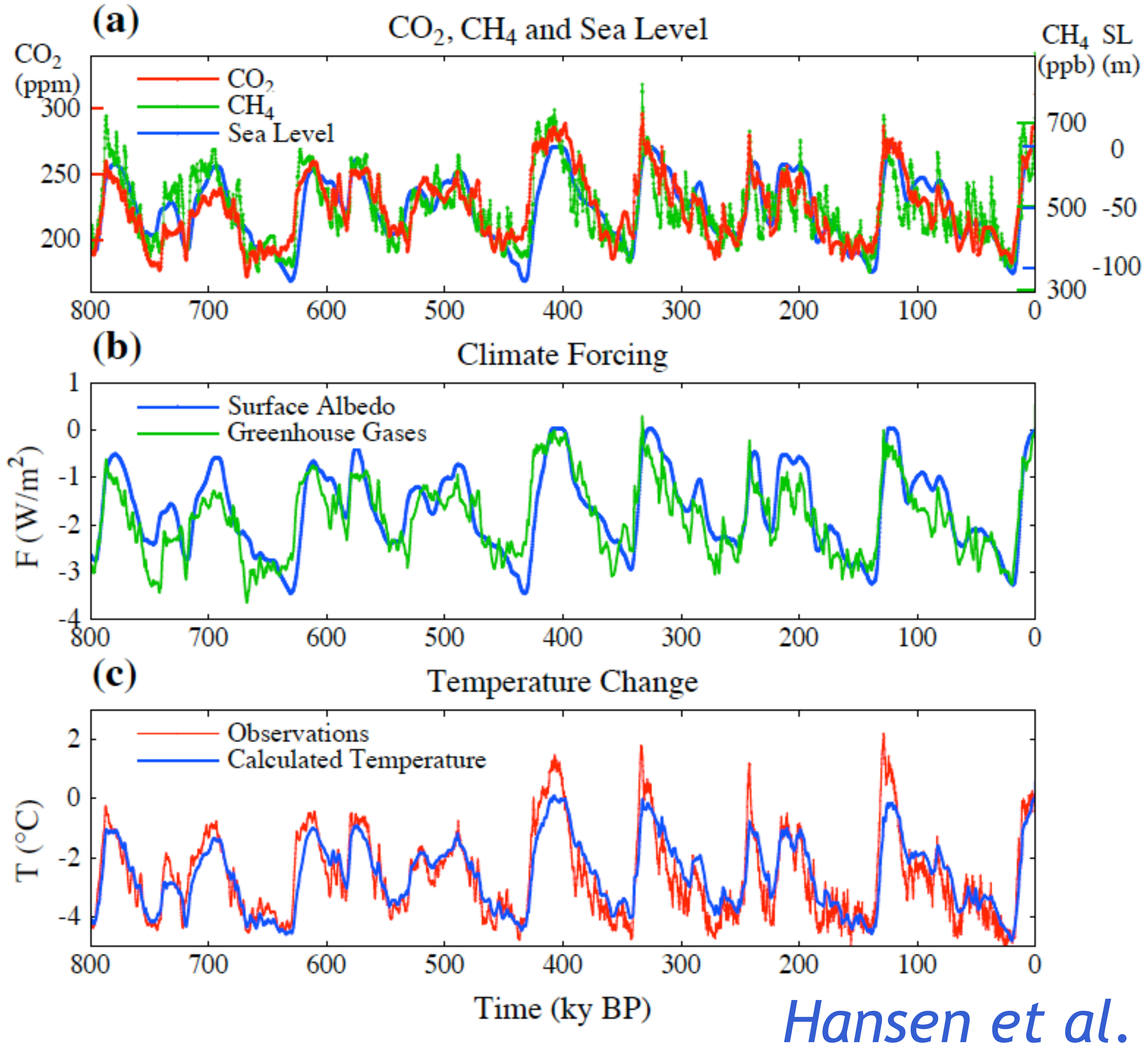
Future Sea Level Rise

Question: What is the probability density function for sea level change per century?

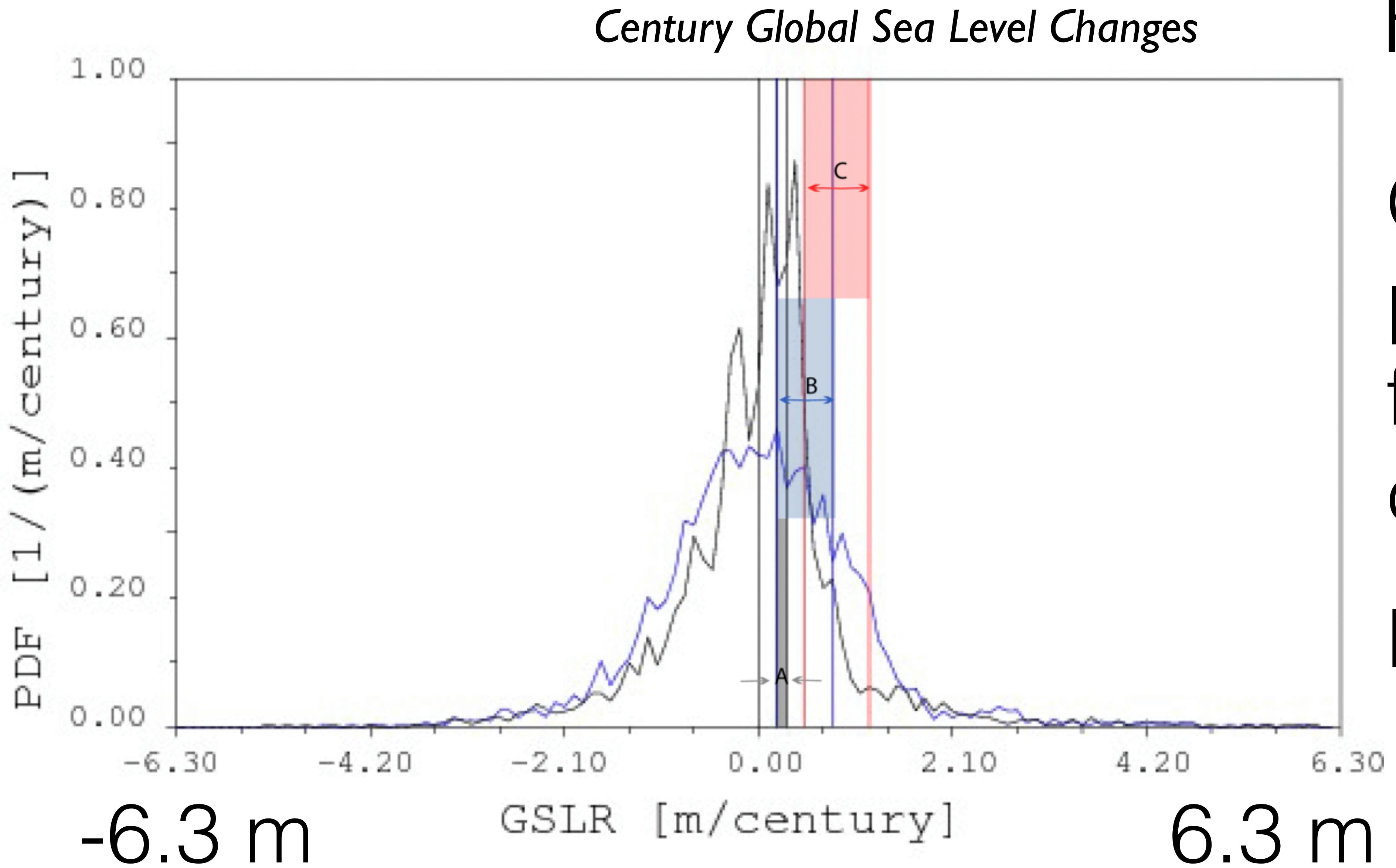
Look at paleo-data …

Sea Level Rise

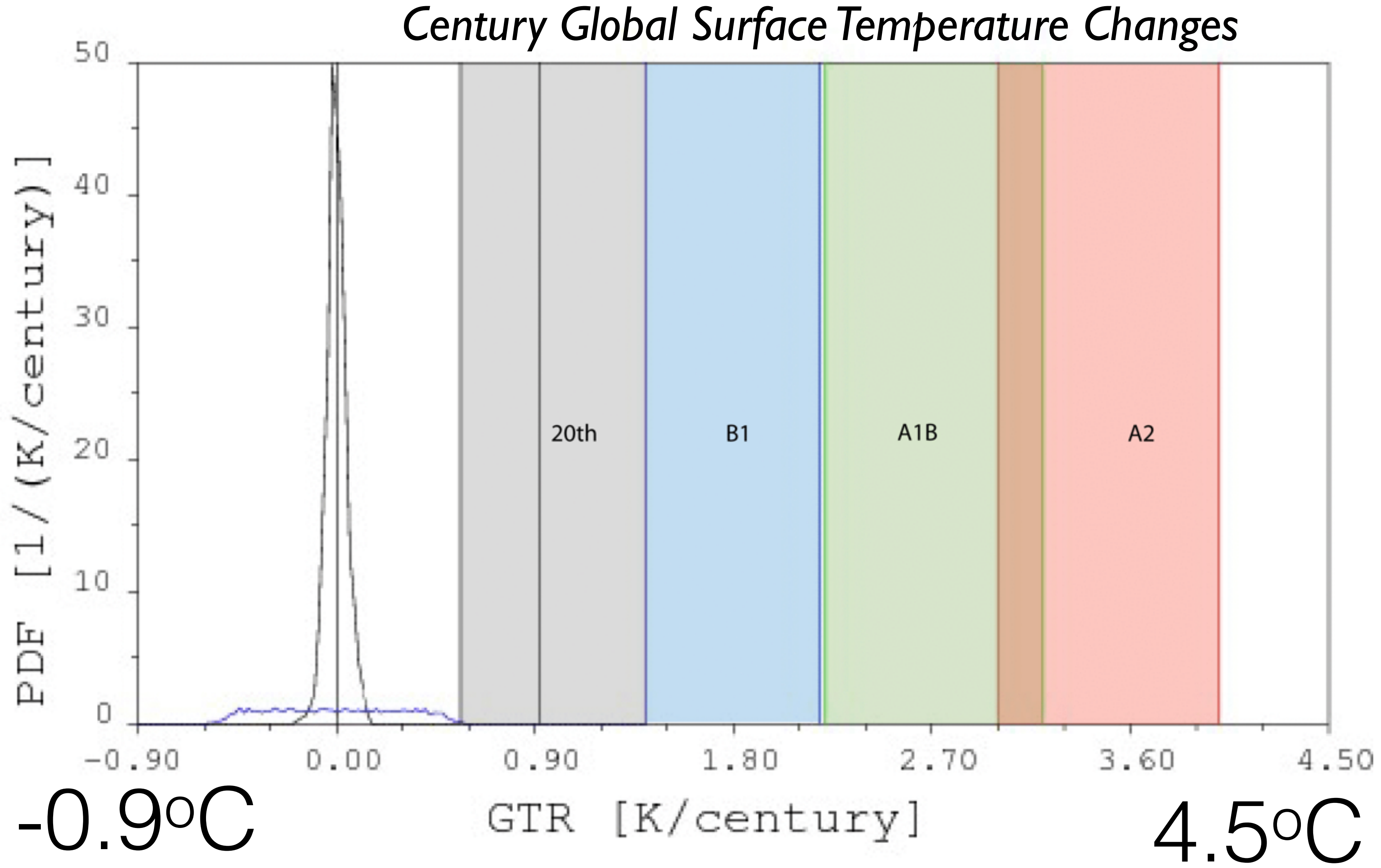




Hansen et al. (2008)



-6.3 m 6.3 m



-0.9°C 4.5°C

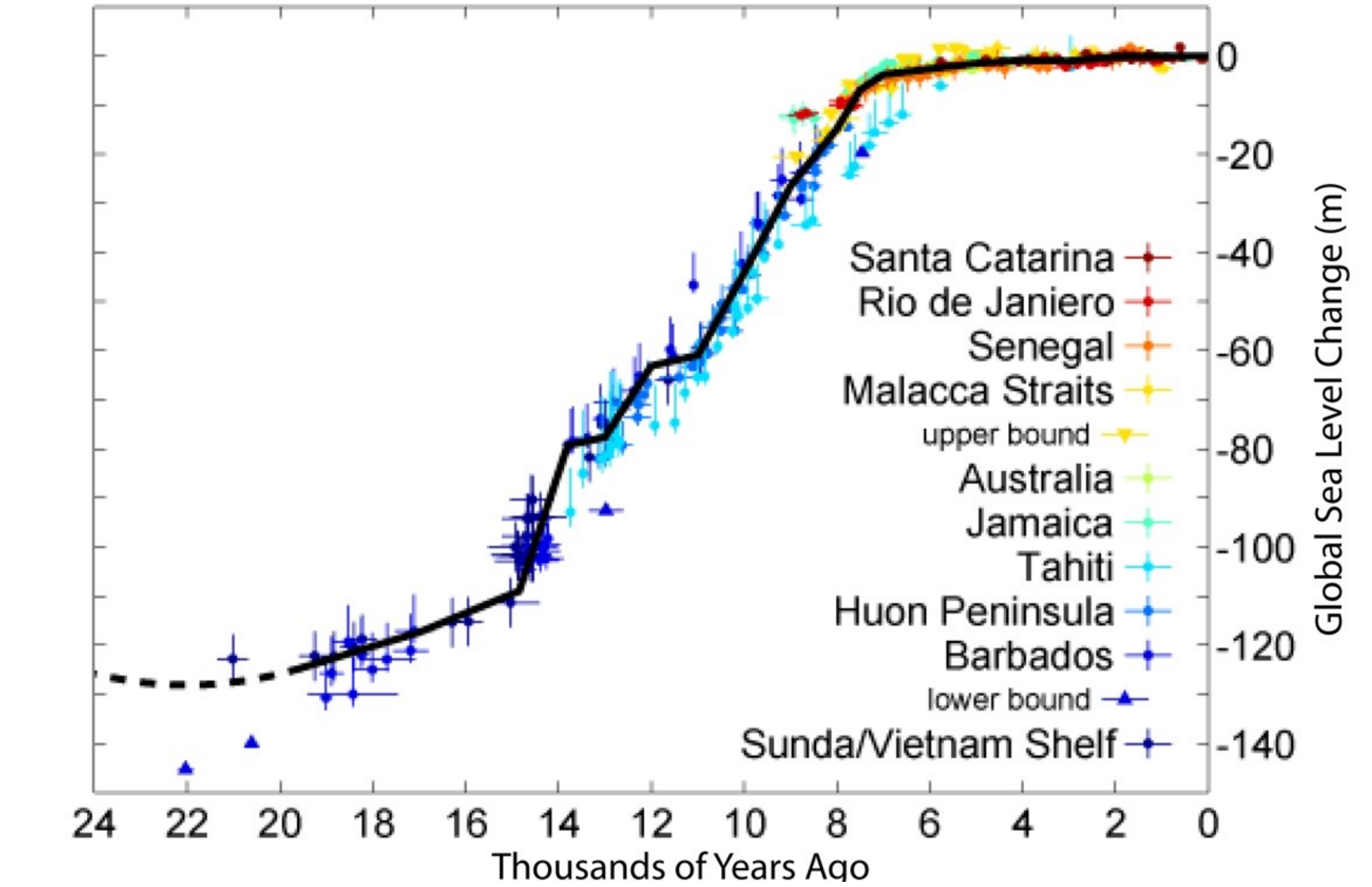
Plag and Jules-Plag (2013)

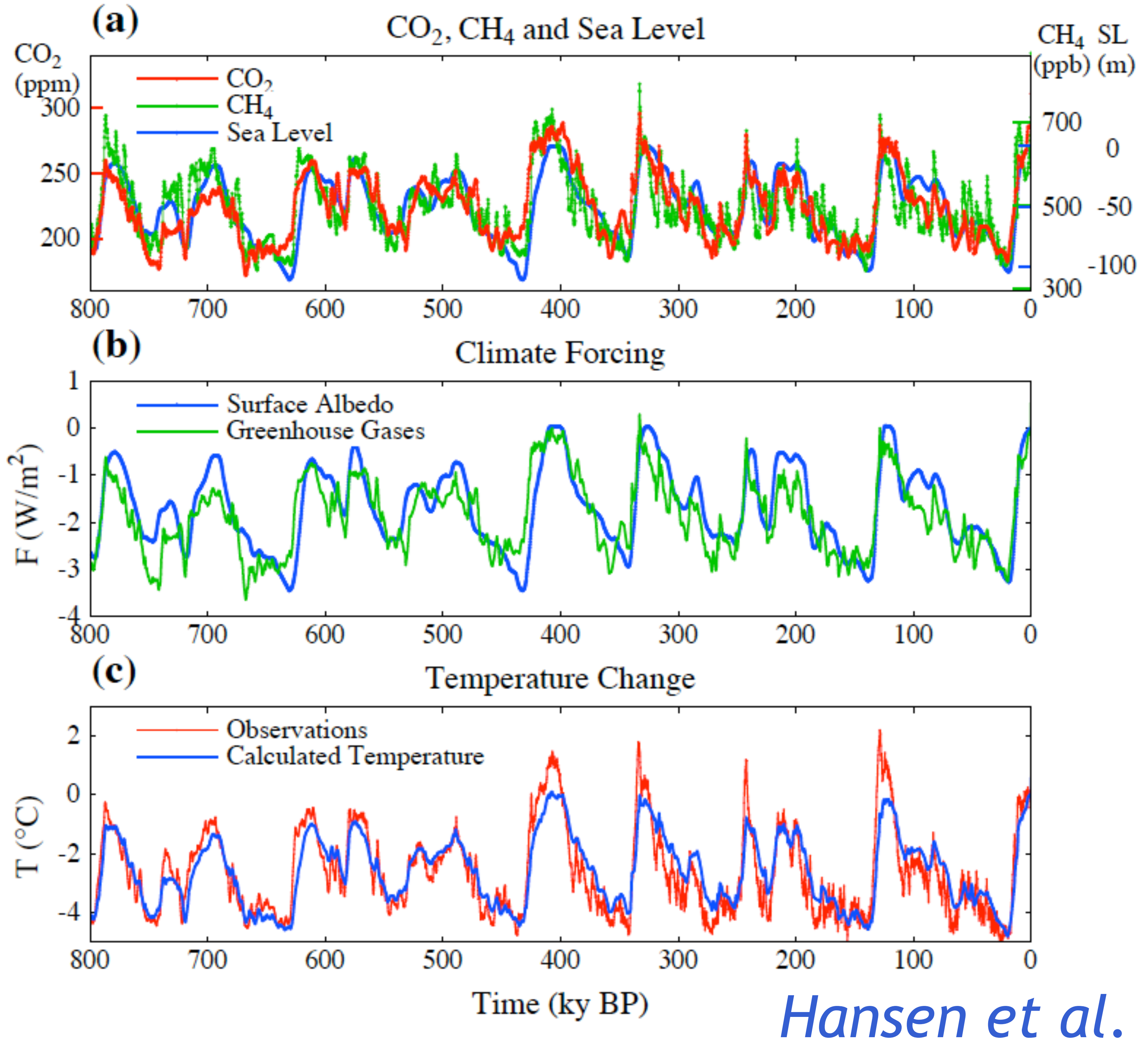
Future Sea Level Rise

Question: What is the probability density function for sea level change per century?

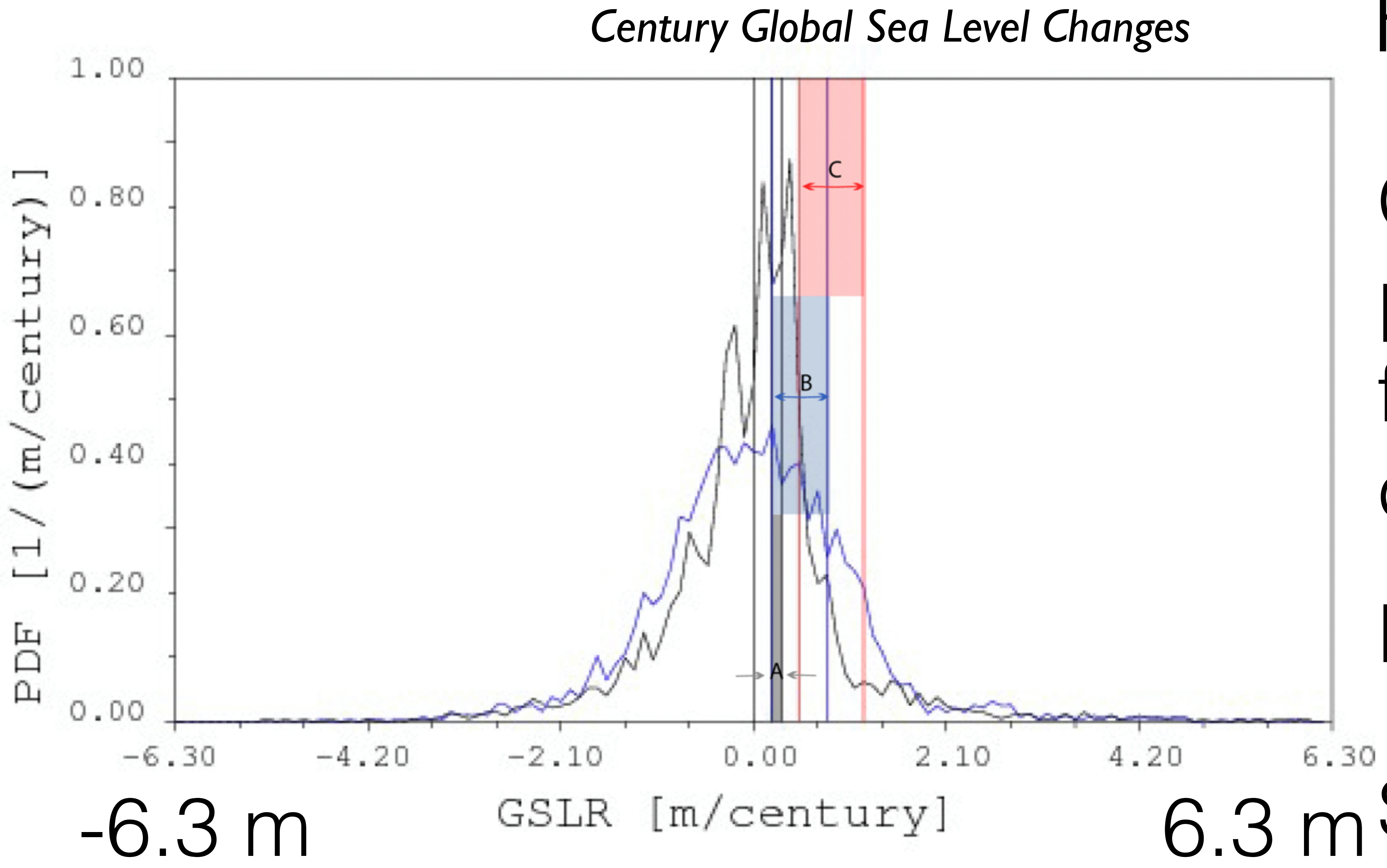
Look at paleo-data …

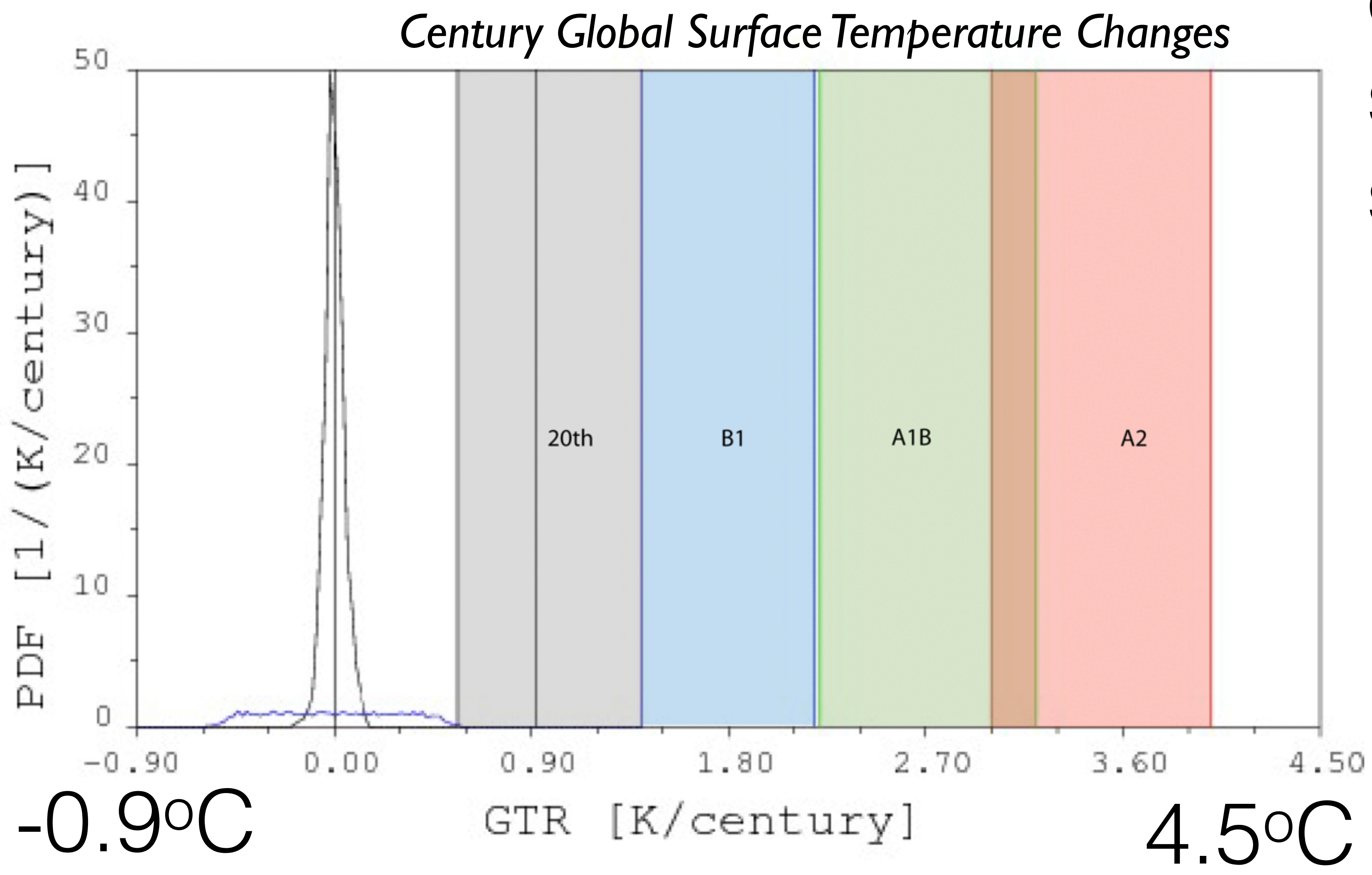
Sea Level Rise





Hansen et al. (2008)





Plag and Jules-Plag (2013)

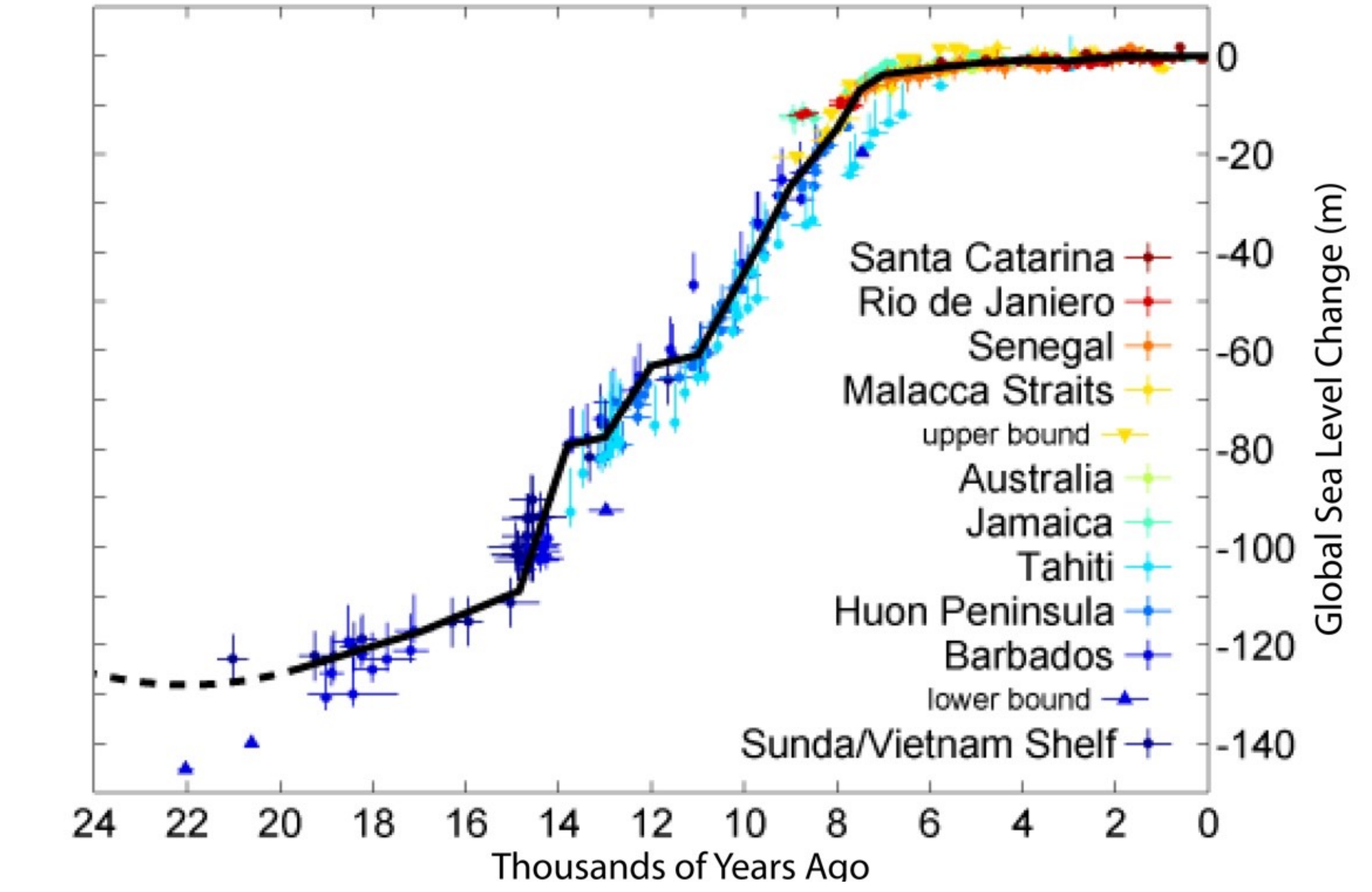
Future Sea Level Rise

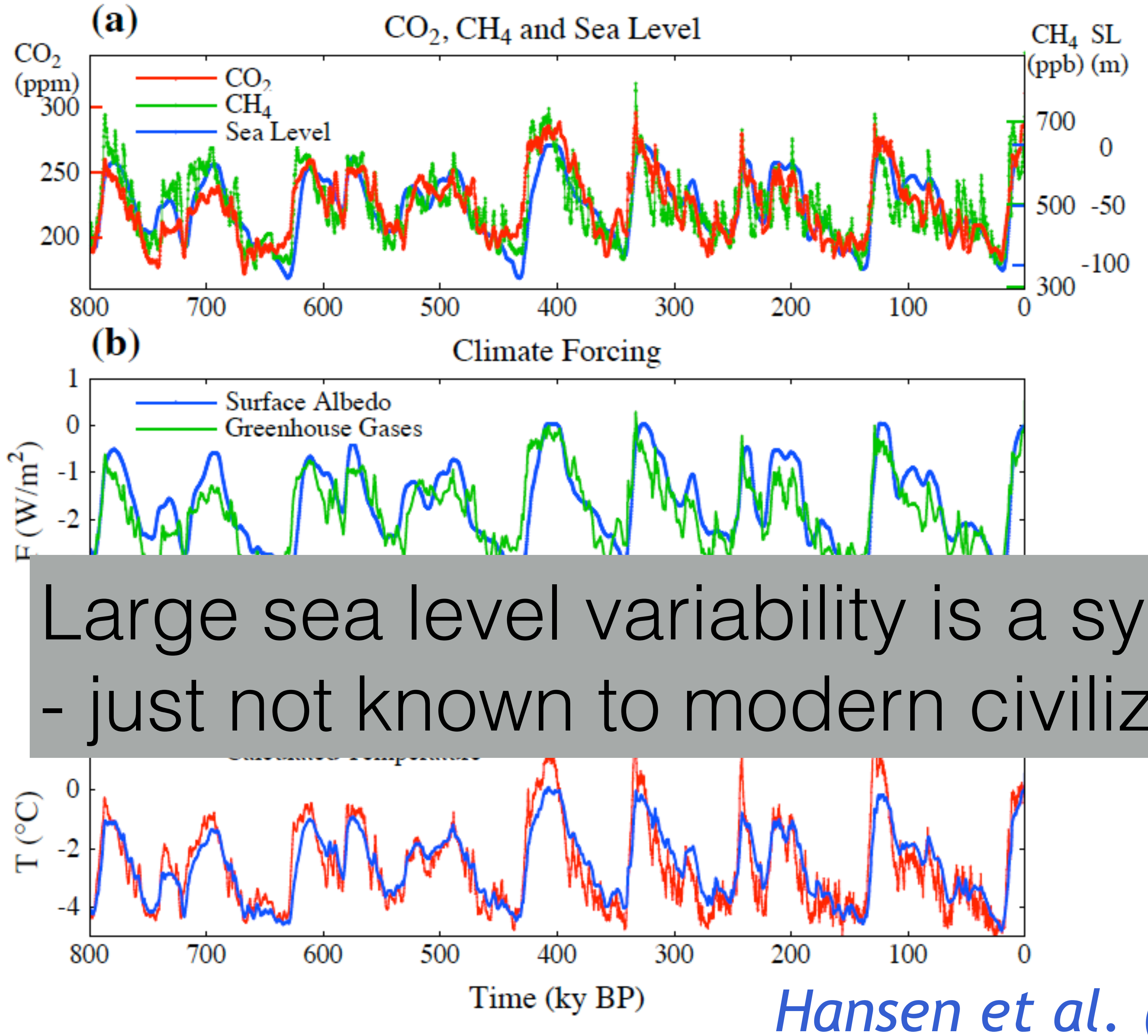
Question: What is the probability density function for sea level change per century?

Look at paleo-data …

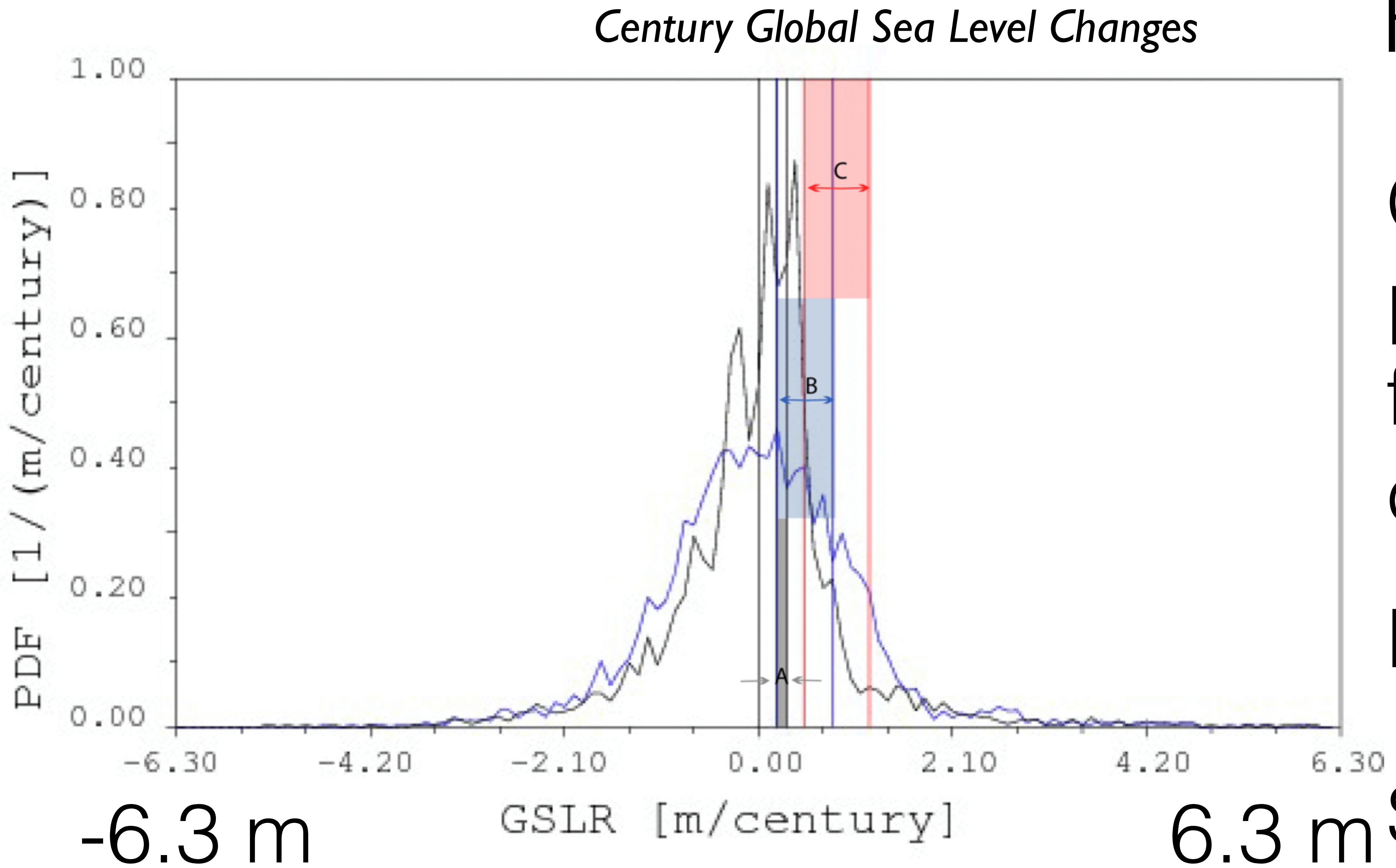
Scientifically, we cannot exclude a large, rapid global sea level rise with large spatial variability in local sea level rise.

Sea Level Rise

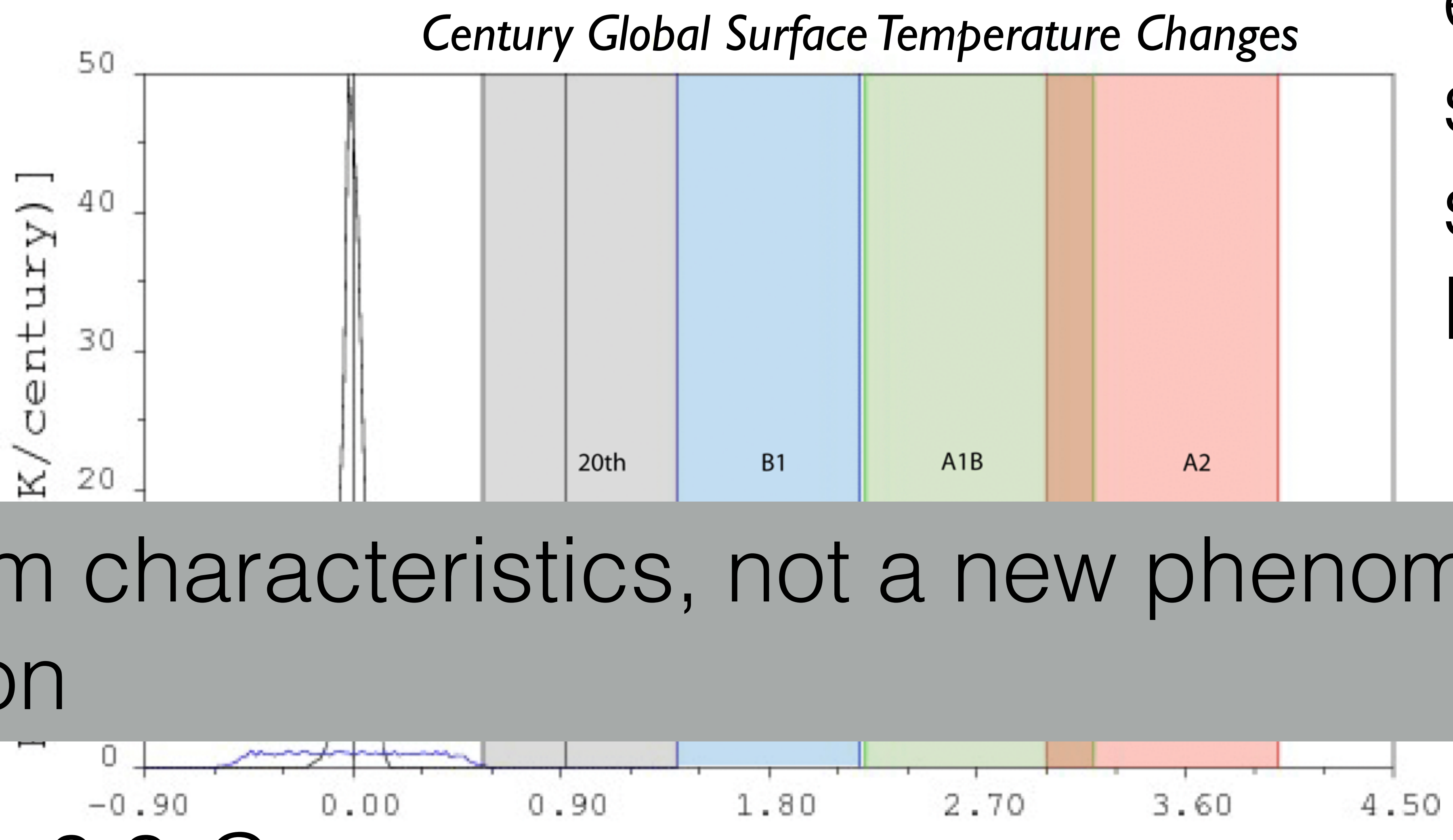




Hansen et al. (2008)



-6.3 m   6.3 m



-0.9°C   4.5°C

Plag and Jules-Plag (2013)

Future Sea Level Rise

Question: What is the probability density function for sea level change per century?

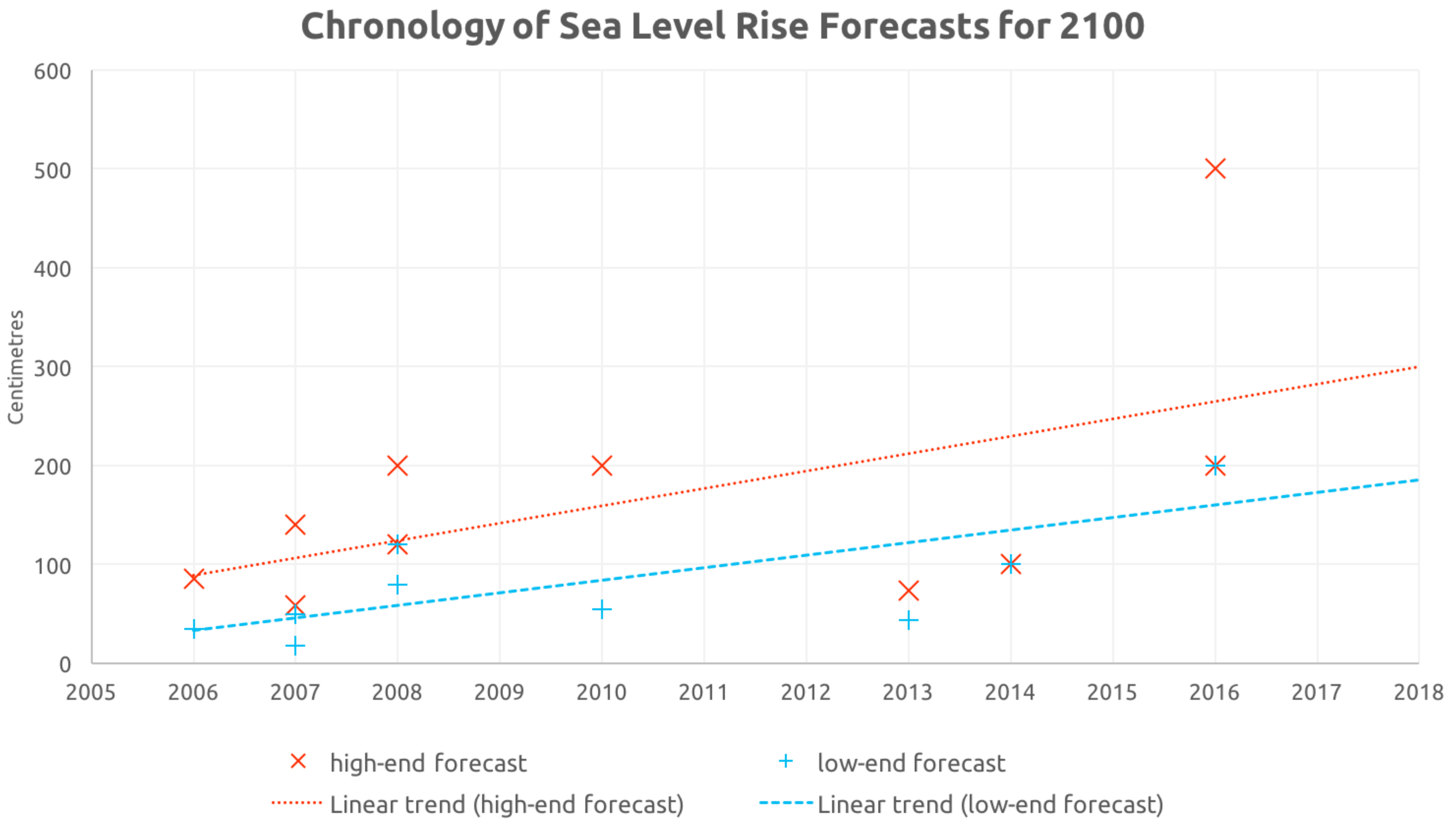
Look at paleo-data …

Scientifically, we cannot exclude a large, rapid global sea level rise with large spatial variability in local sea level rise.

Large sea level variability is a system characteristics, not a new phenomenon, not a problem - just not known to modern civilization

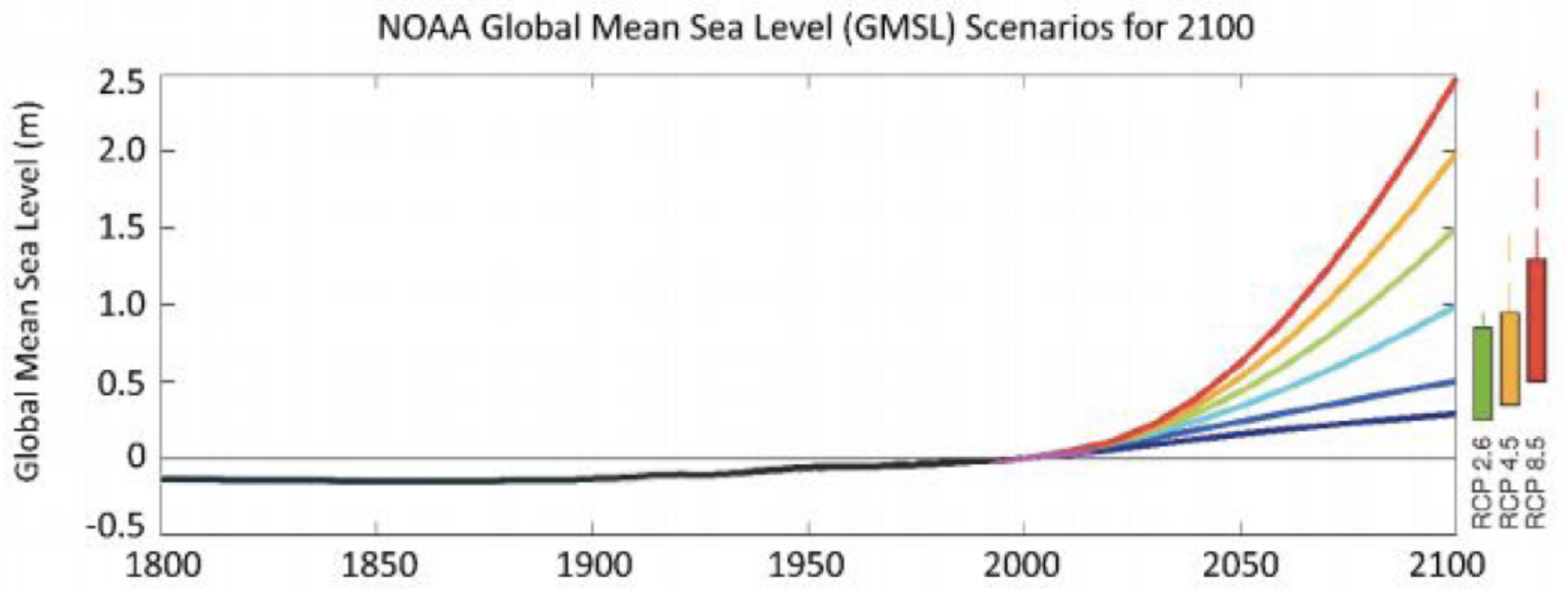
Sea Level Rise

Sea Level Rise



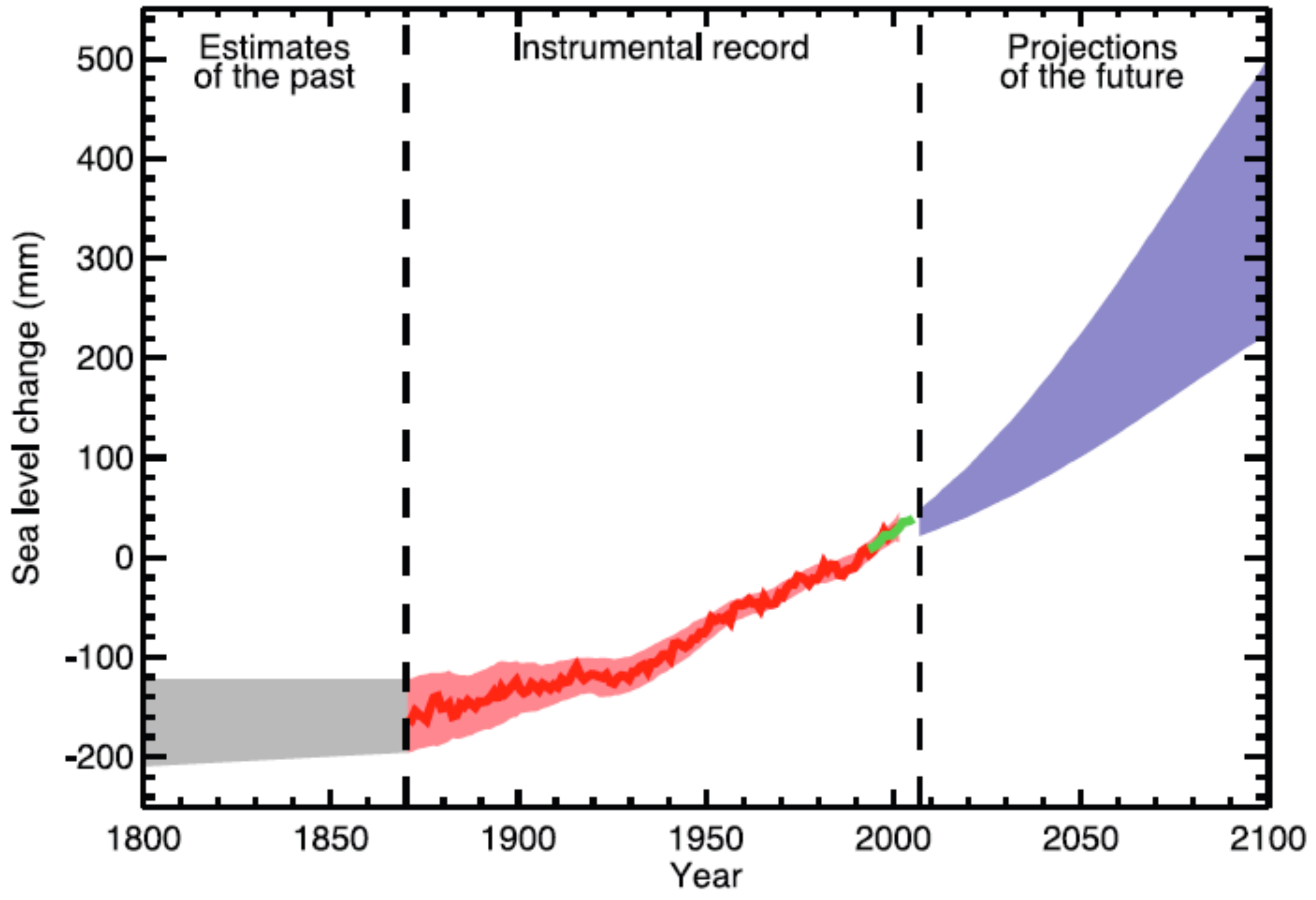
Studies & reports, in order: KNMI'06, IPCC AR4, Rahmstorf (Science), Delta Committee, Pfeffer (Science), National Research Council, IPCC AR5, KNMI'14, DeConto (Nature), Hansen (AtmsChem&Phys).

Sea Level Rise



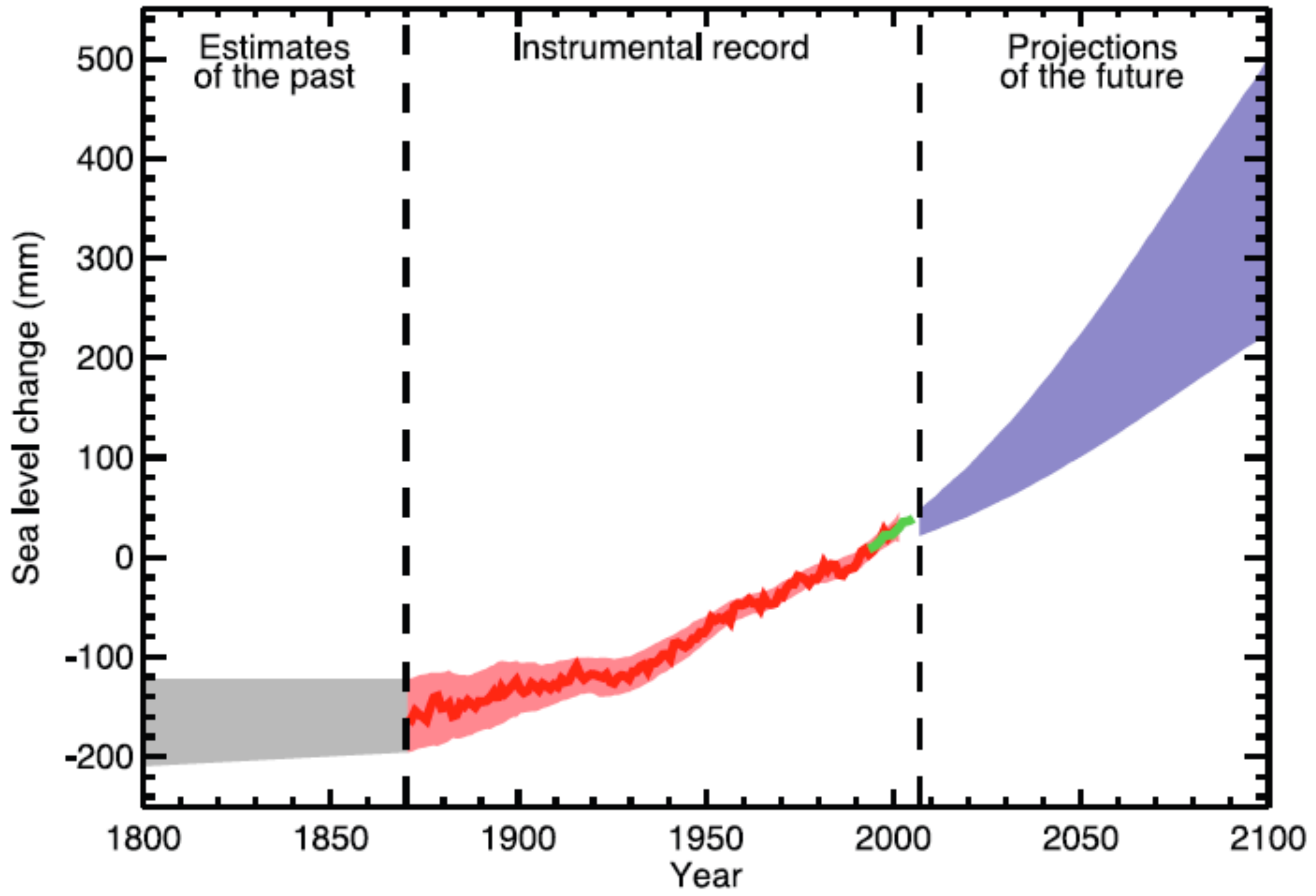
Sea Level Rise

Sea Level Rise

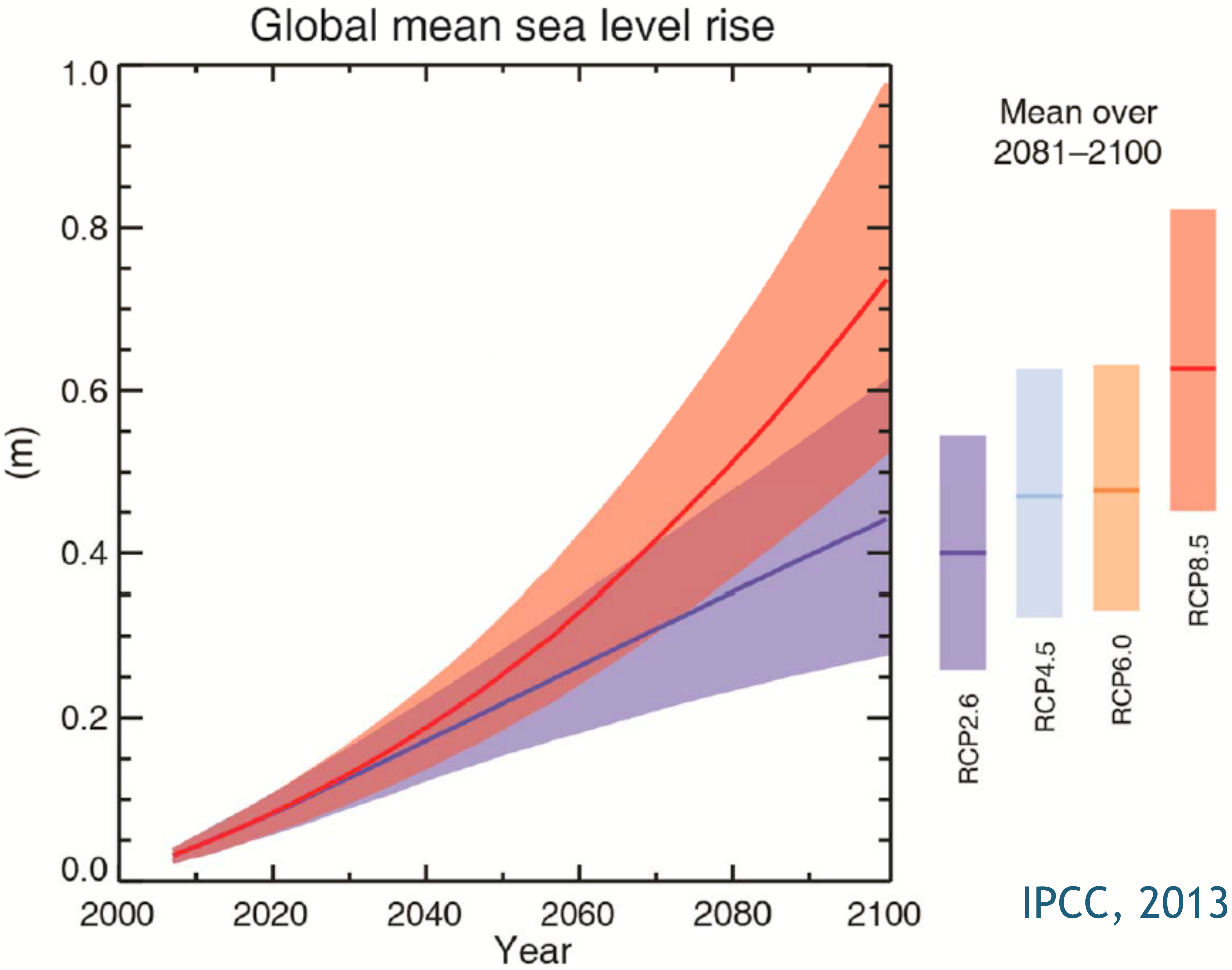


Bindoff et al. (2007)

Sea Level Rise

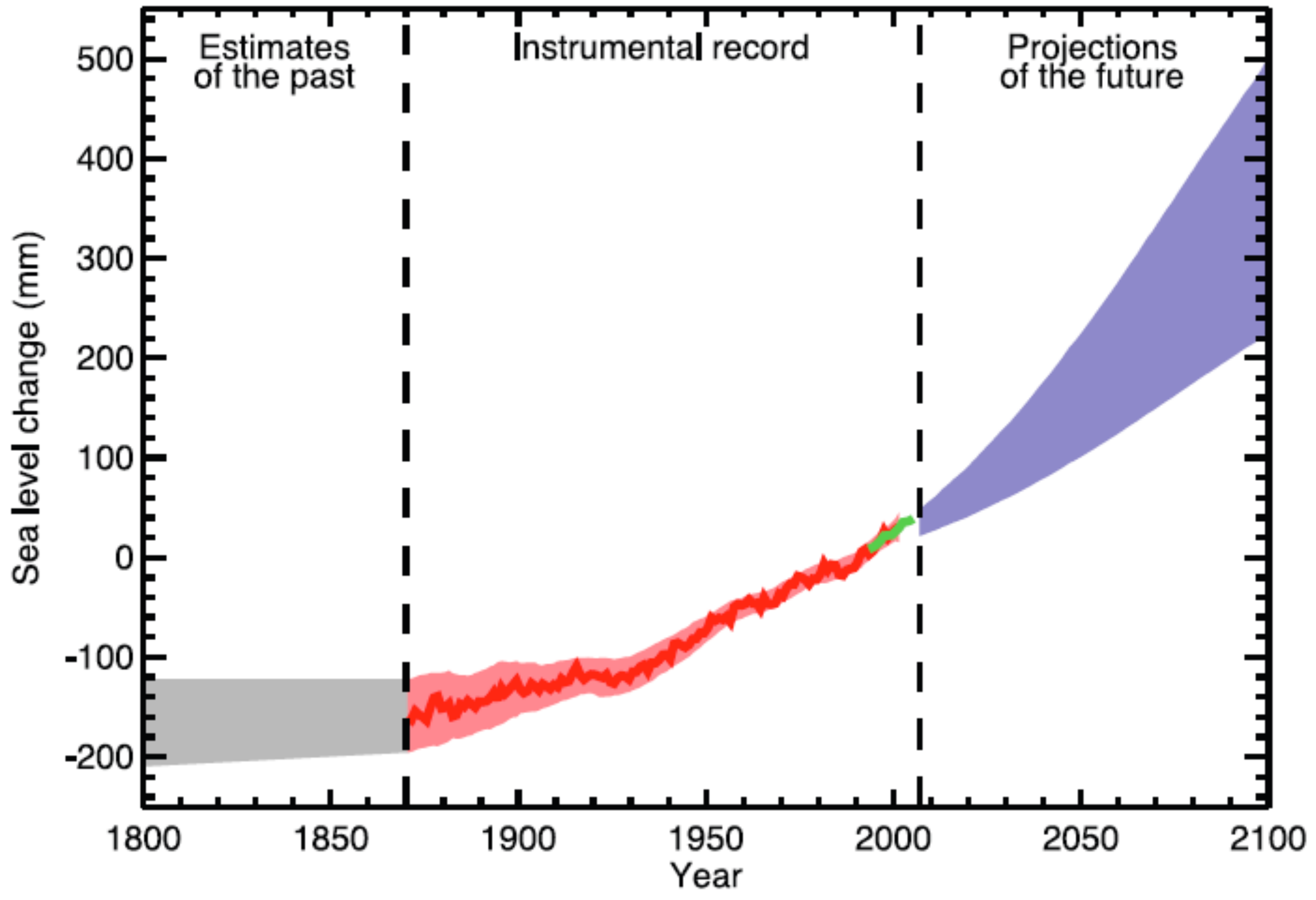


Bindoff et al. (2007)

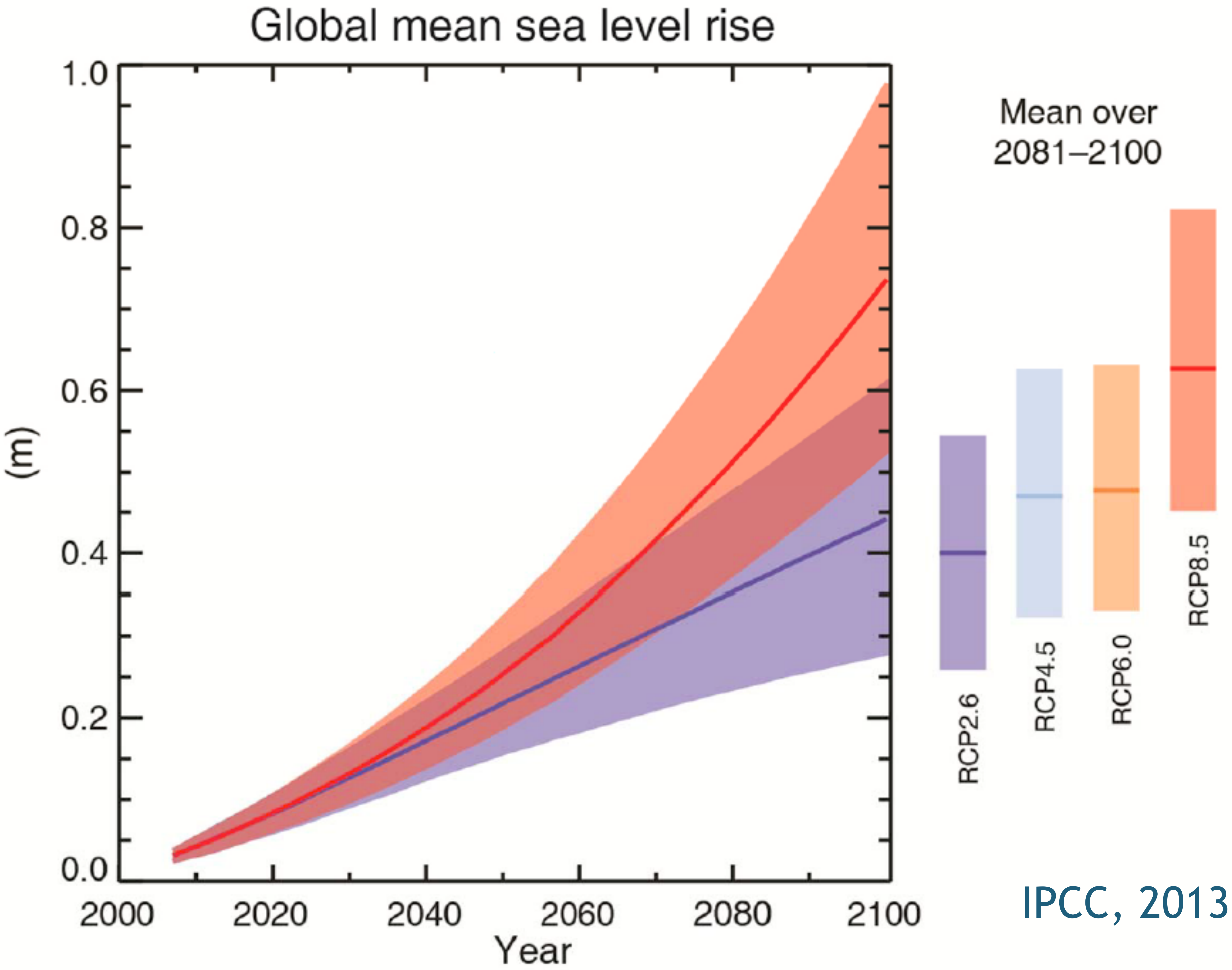


IPCC, 2013

Sea Level Rise



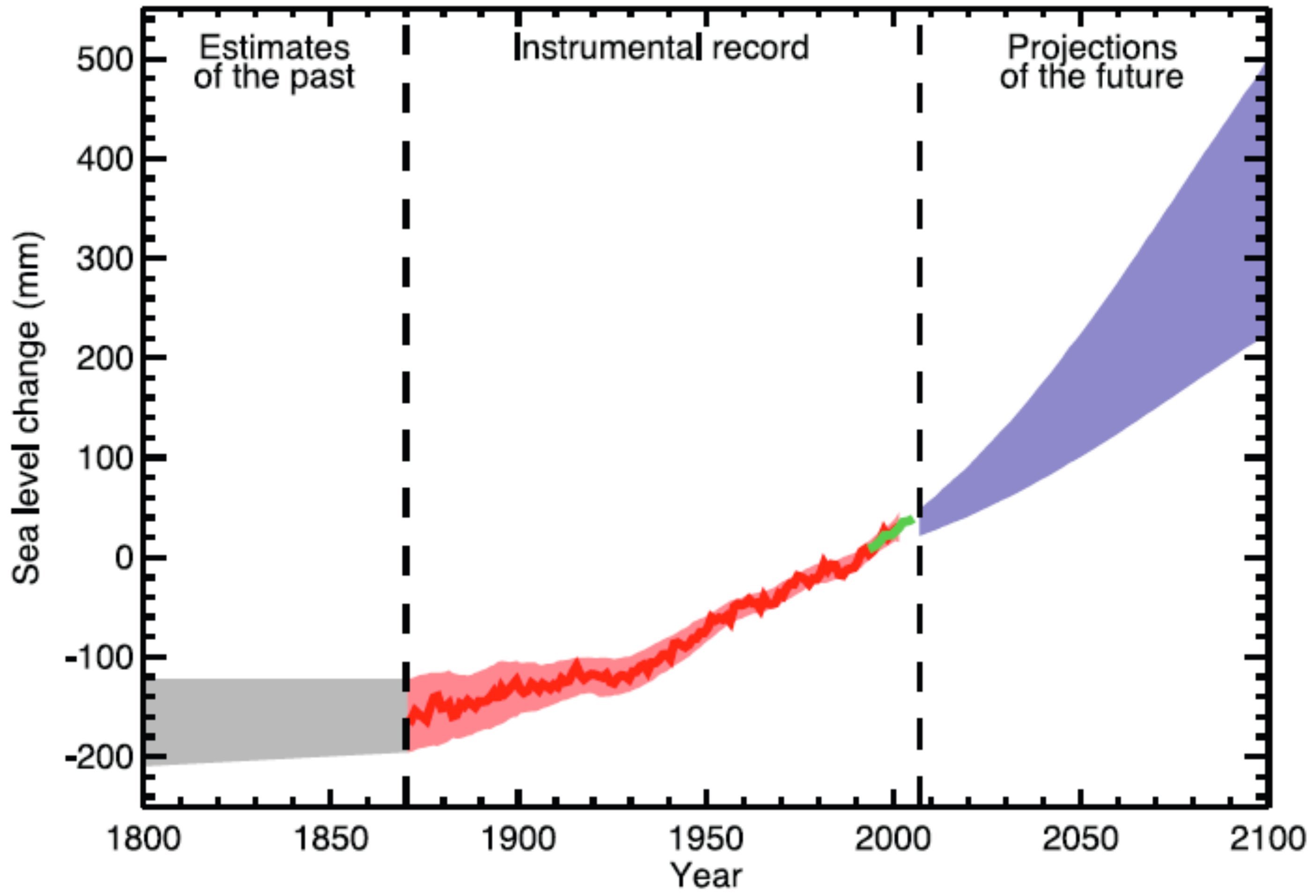
Bindoff et al. (2007)



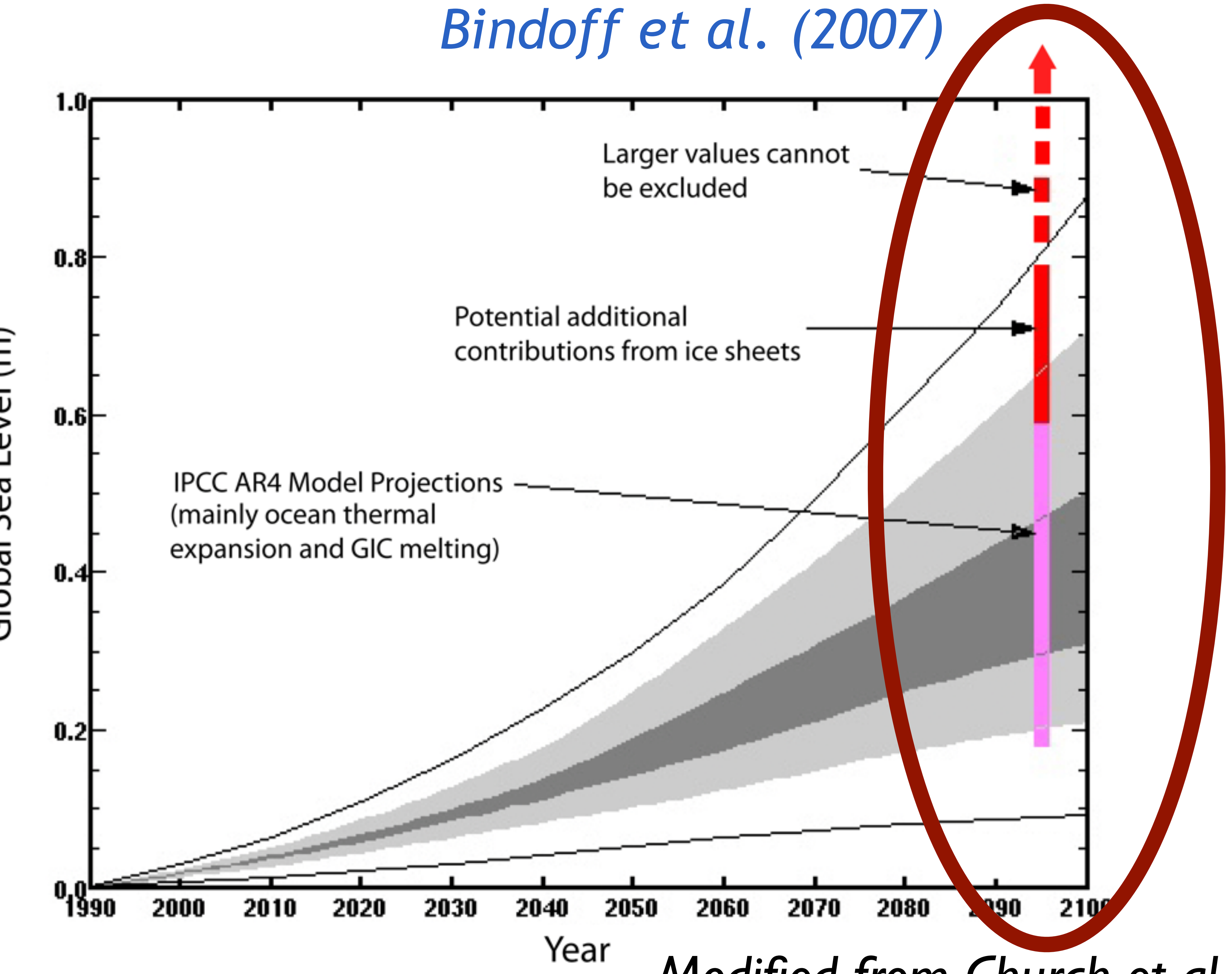
IPCC, 2013

Note: No accelerated contribution from Greenland and Antarctic ice sheets considered

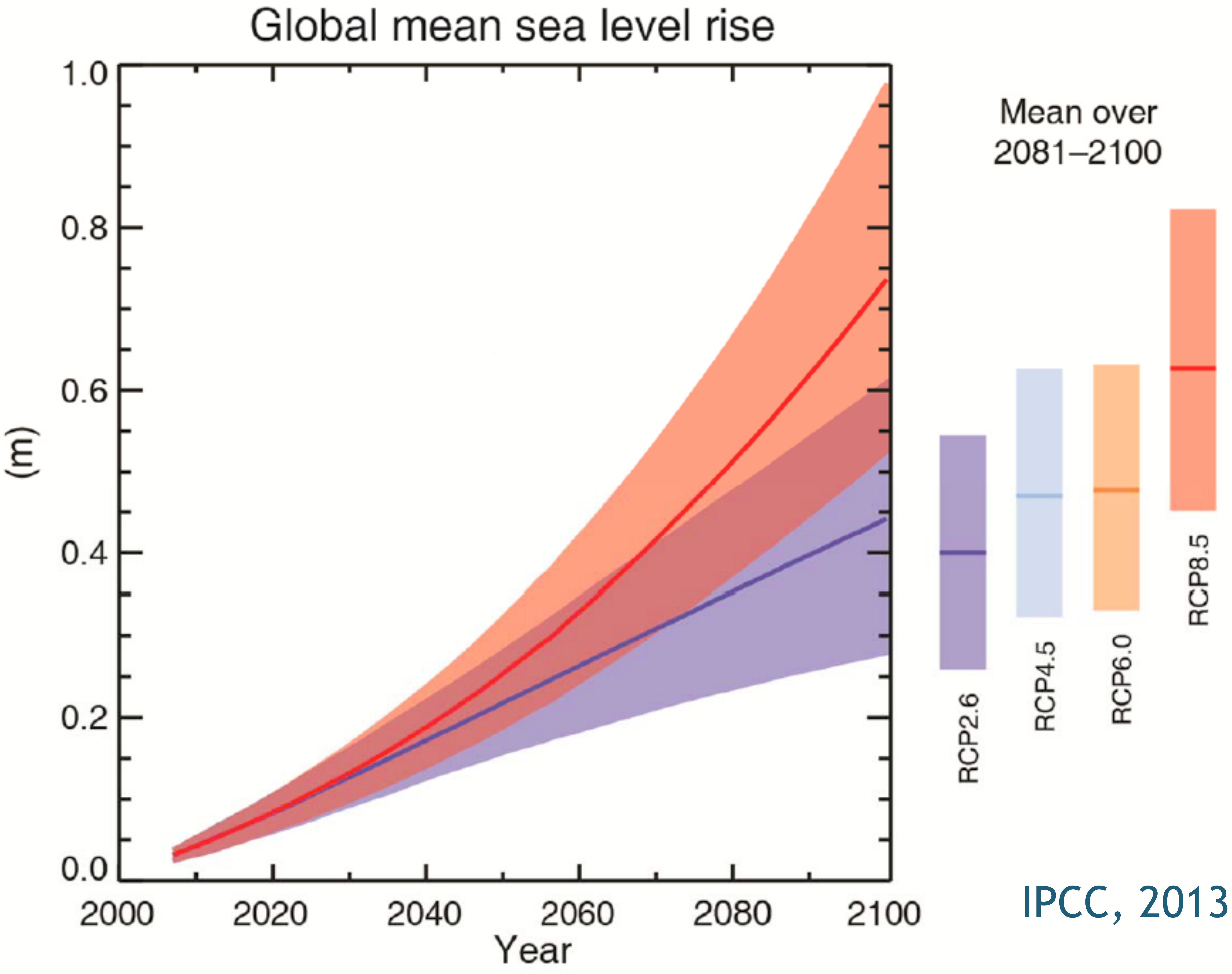
Sea Level Rise



Bindoff et al. (2007)



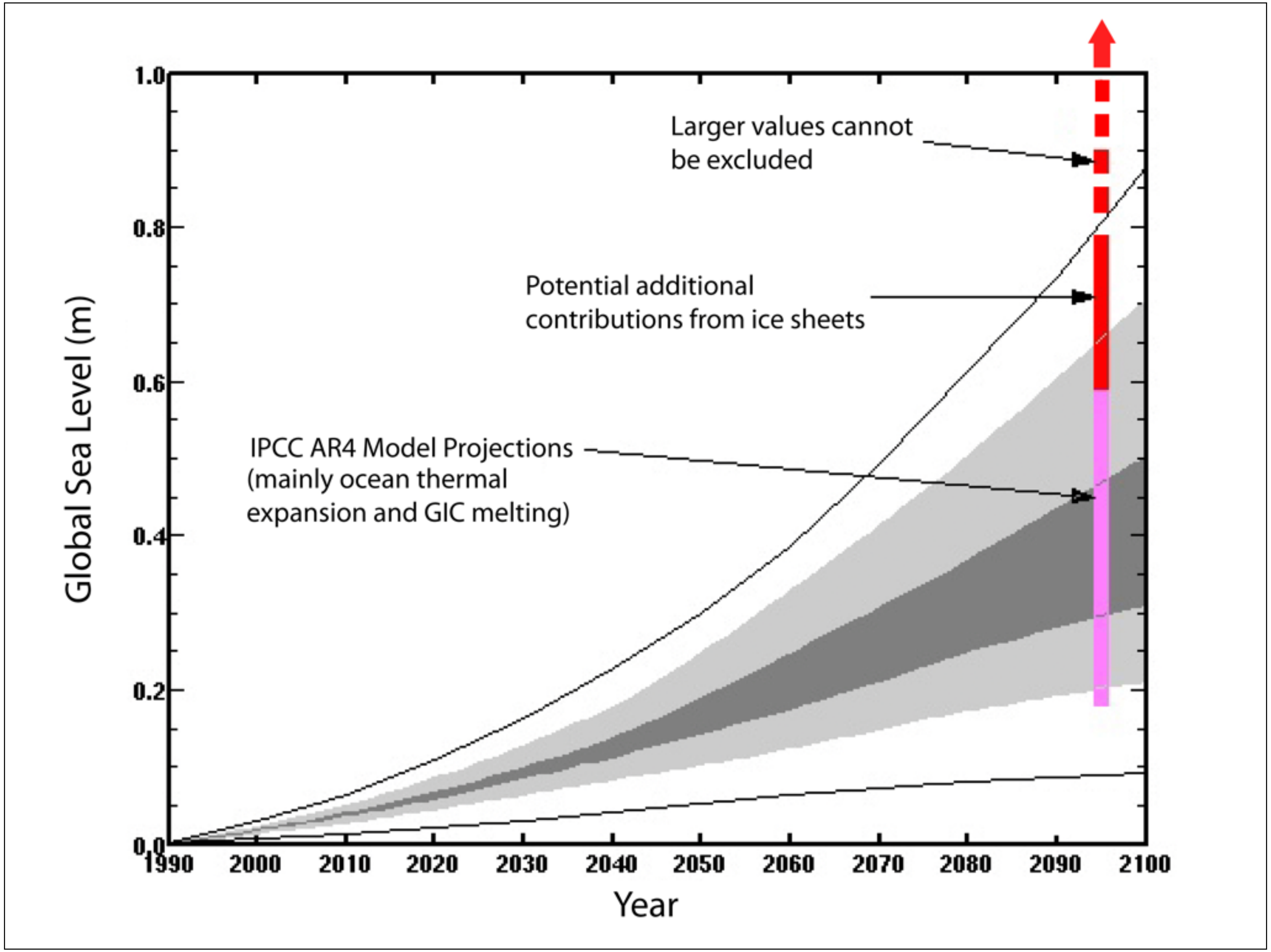
Modified from Church et al. (2010)



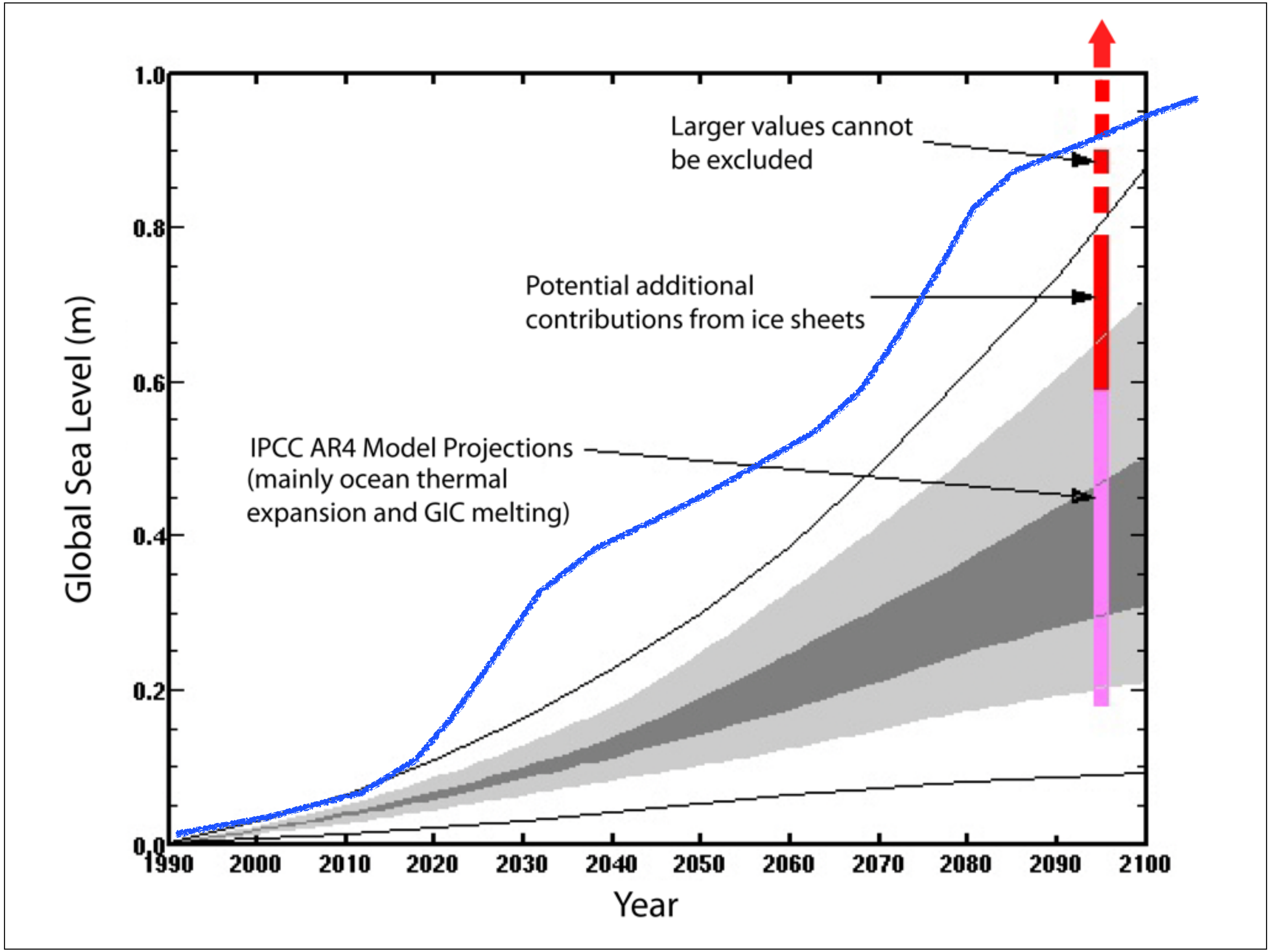
IPCC, 2013

Note: No accelerated contribution from Greenland and Antarctic ice sheets considered

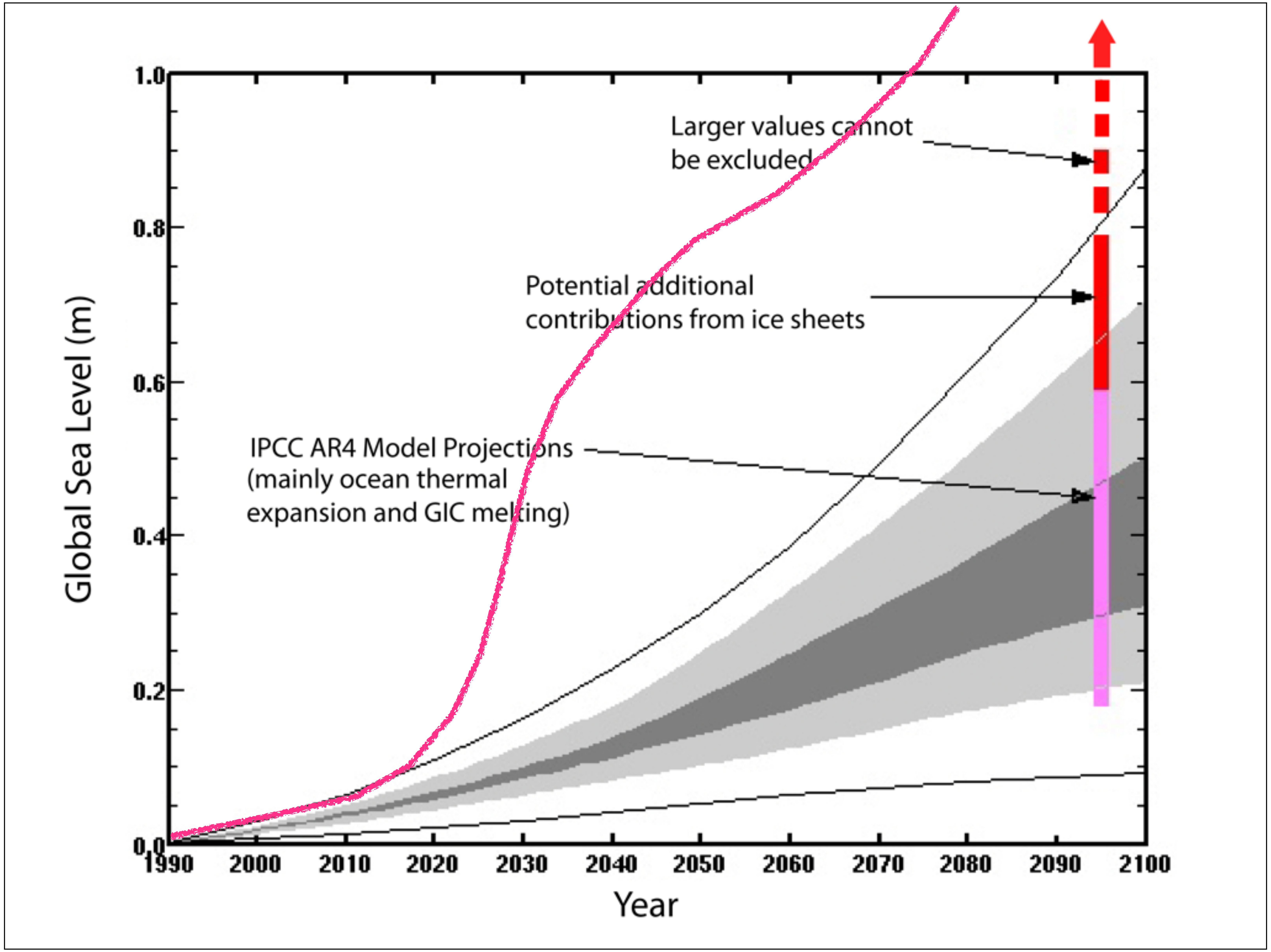
Sea Level Rise



Sea Level Rise



Sea Level Rise



Modified from Church et al. (2010)

Sea Level Rise

Figure 13.18

Figure 13.19

Figure 13.18 | Ensemble mean regional contributions to sea level change (metres) from (a) glacial isostatic adjustment (GIA), (b) glaciers and (c) ice-sheet surface mass balance (SMB). Panels (b) and (c) are based on information available from scenario RCP4.5. All panels represent changes between the periods 1986–2000 and 2081–2100.

Figure 13.19 | (a) Ensemble mean regional relative sea level change (m) evaluated from 21 models of the CMIP5 scenario RCP 4.5, including atmospheric loading, plus land-ice, GIA and terrestrial water sources, between 1986–2005 and 2081–2100. Global mean is 0.48 m, with a total range of -1.74 to +0.71 m. (b) The local, lower 90% uncertainty bound (p=0.05) for RCP4.5 scenario sea level rise (plus non-scenario components). (c) The local, upper 90% uncertainty bound (p=0.95) for RCP4.5 scenario sea level rise (plus non-scenario components). Note that the global mean is different from the value in Table 13.5, by less than 0.01 m, because a slightly different set of CMIP5 models was used (see the Supplementary Material) and that panels (b) and (c) contain local uncertainties not present in global uncertainties.

Sea Level Rise

Figure 13.18

Figure 13.19

Figure 13.18 | Ensemble mean regional contributions to sea level change (metres) from (a) glacial isostatic adjustment (GIA), (b) glaciers and (c) ice-sheet surface mass balance (SMB). Panels (b) and (c) are based on information available from scenario RCP4.5. All panels represent changes between the periods 1986–2000 and 2081–2100.

Figure 13.19 | (a) Ensemble mean regional relative sea level change (m) evaluated from 21 models of the CMIP5 scenario RCP 4.5, including atmospheric loading, plus land-ice, GIA and terrestrial water sources, between 1986–2005 and 2081–2100. Global mean is 0.48 m, with a total range of -1.74 to +0.71 m. (b) The local, lower 90% uncertainty bound (p=0.05) for RCP4.5 scenario sea level rise (plus non-scenario components). (c) The local, upper 90% uncertainty bound (p=0.95) for RCP4.5 scenario sea level rise (plus non-scenario components). Note that the global mean is different from the value in Table 13.5, by less than 0.01 m, because a slightly different set of CMIP5 models was used (see the Supplementary Material) and that panels (b) and (c) contain local uncertainties not present in global uncertainties.

IPCC, 2013

Sea Level Rise

Figure 13.18

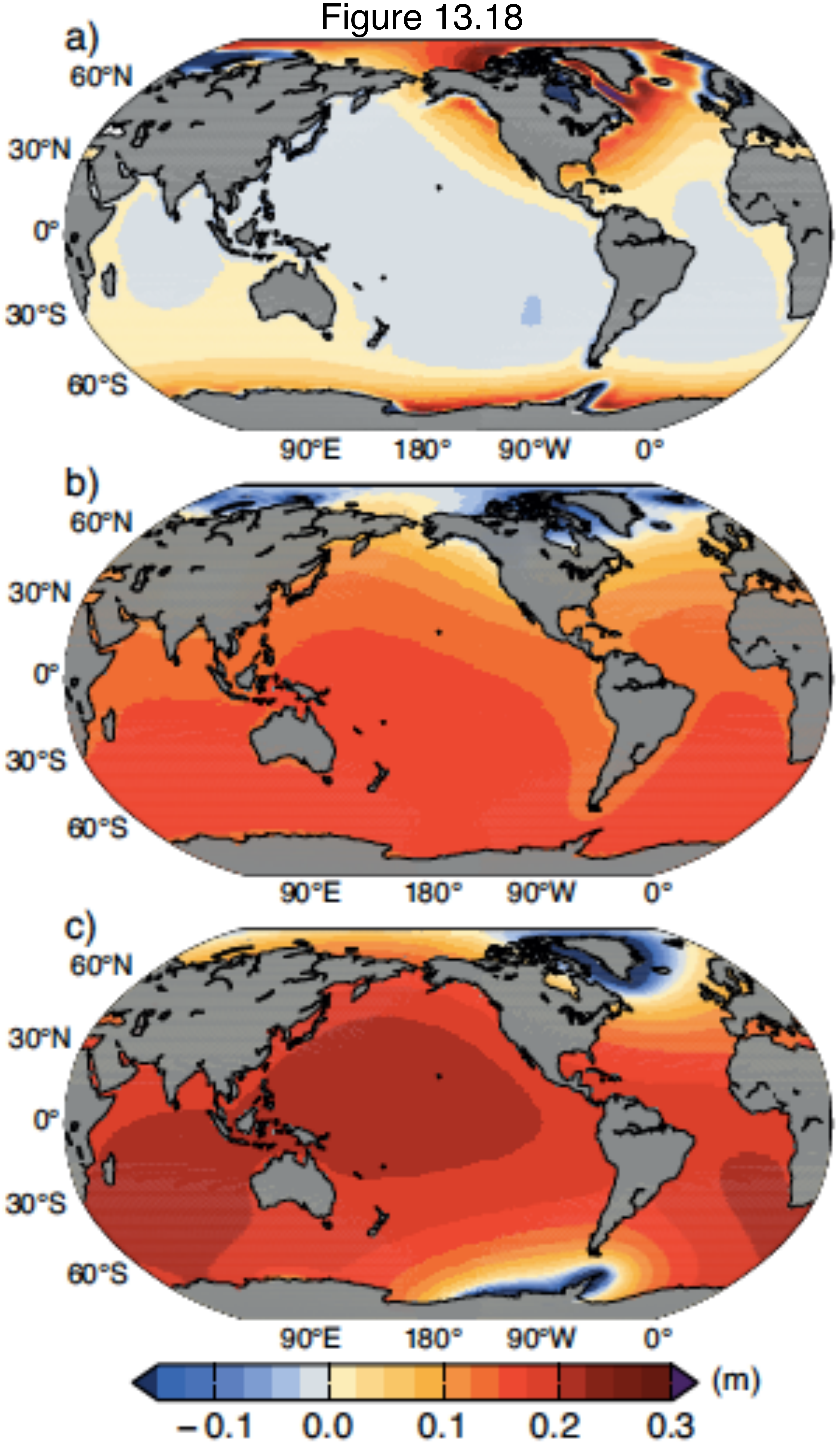


Figure 13.19

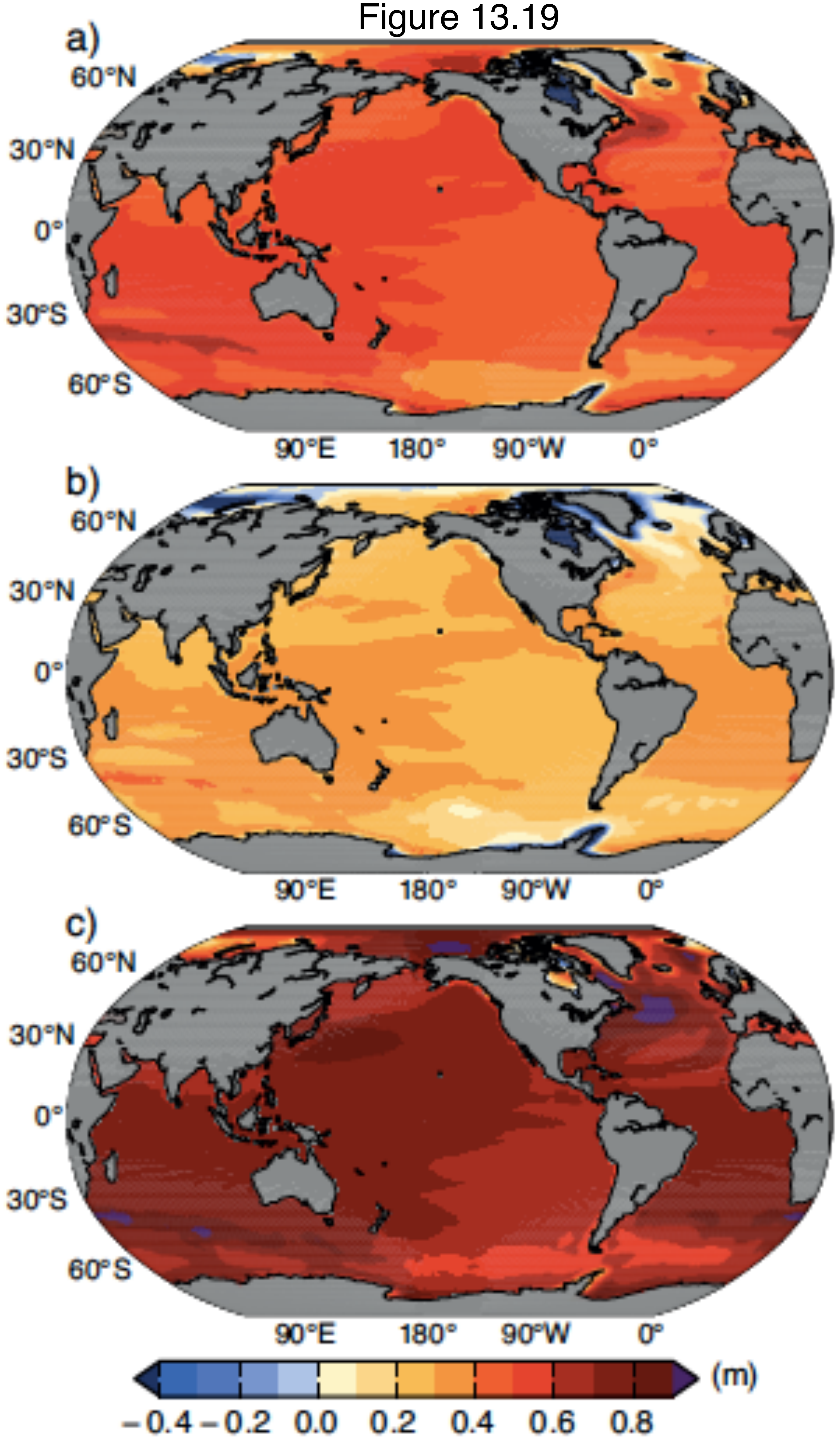


Figure 13.18 | Ensemble mean regional contributions to sea level change (metres) from (a) glacial isostatic adjustment (GIA), (b) glaciers and (c) ice-sheet surface mass balance (SMB). Panels (b) and (c) are based on information available from scenario RCP4.5. All panels represent changes between the periods 1986–2000 and 2081–2100.

Figure 13.19 | (a) Ensemble mean regional relative sea level change (m) evaluated from 21 models of the CMIP5 scenario RCP 4.5, including atmospheric loading, plus land-ice, GIA and terrestrial water sources, between 1986–2005 and 2081–2100. Global mean is 0.48 m, with a total range of -1.74 to +0.71 m. (b) The local, lower 90% uncertainty bound (p=0.05) for RCP4.5 scenario sea level rise (plus non-scenario components). (c) The local, upper 90% uncertainty bound (p=0.95) for RCP4.5 scenario sea level rise (plus non-scenario components). Note that the global mean is different from the value in Table 13.5, by less than 0.01 m, because a slightly different set of CMIP5 models was used (see the Supplementary Material) and that panels (b) and (c) contain local uncertainties not present in global uncertainties.

IPCC, 2013

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?

Accepted knowledge in 2000:

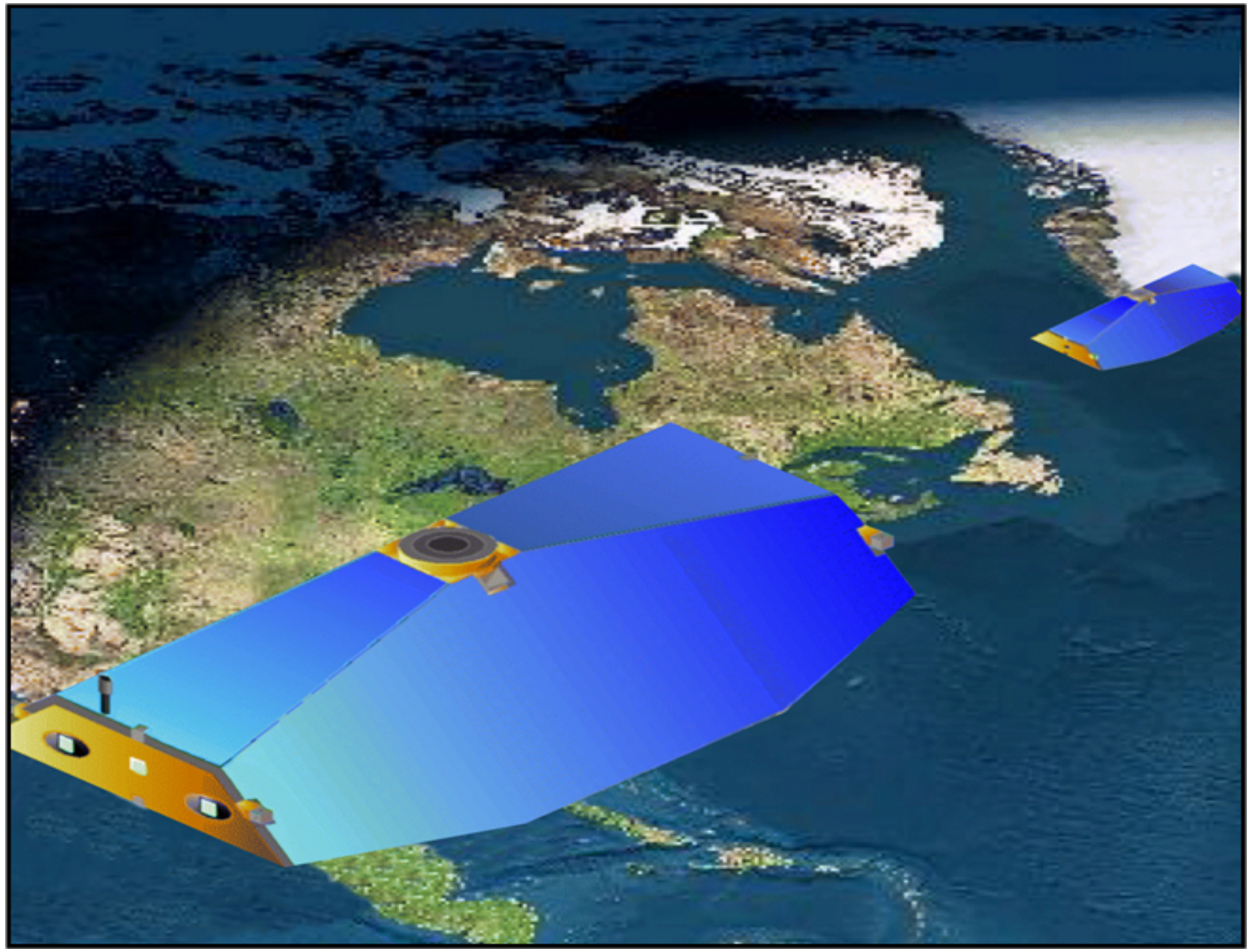
Greenland: no significant contribution to sea level rise

Antarctica: minor contribution

Main contribution: steric changes

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?



Gravity Recovery and Climate Experiment (GRACE)

Accepted knowledge in 2000:

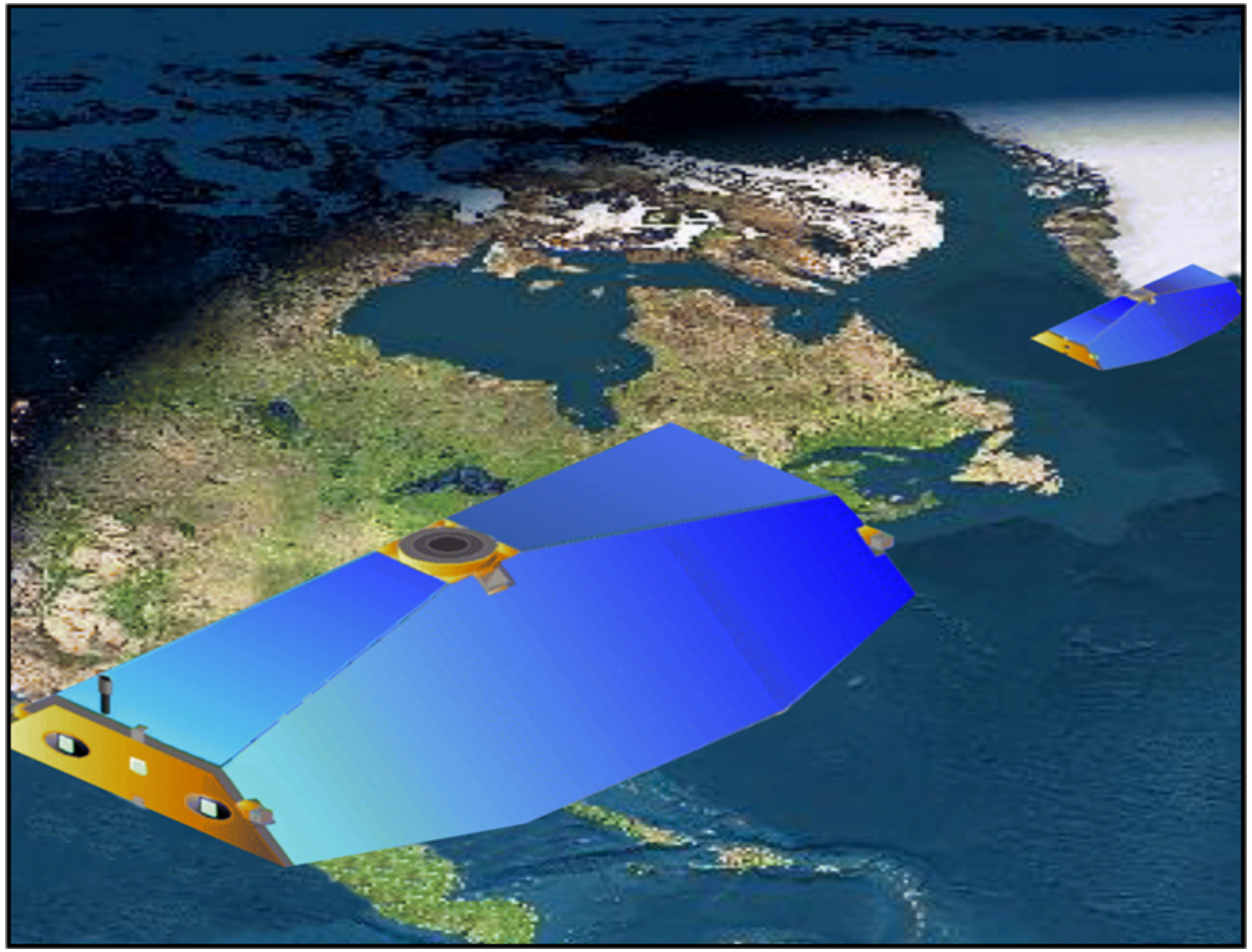
Greenland: no significant contribution to sea level rise

Antarctica: minor contribution

Main contribution: steric changes

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?



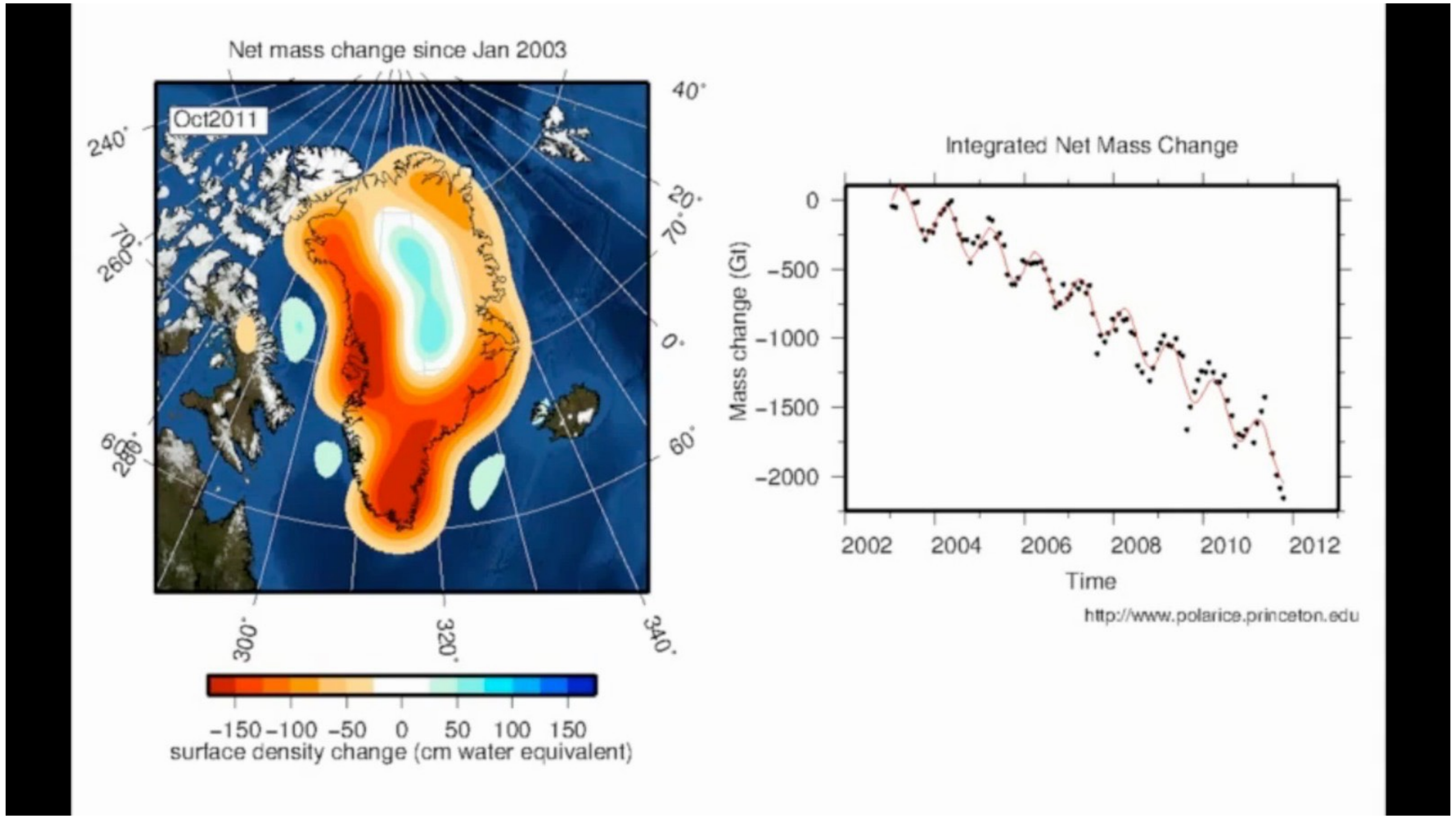
Gravity Recovery and Climate Experiment (GRACE)

Accepted knowledge in 2000:

Greenland: no significant contribution to sea level rise

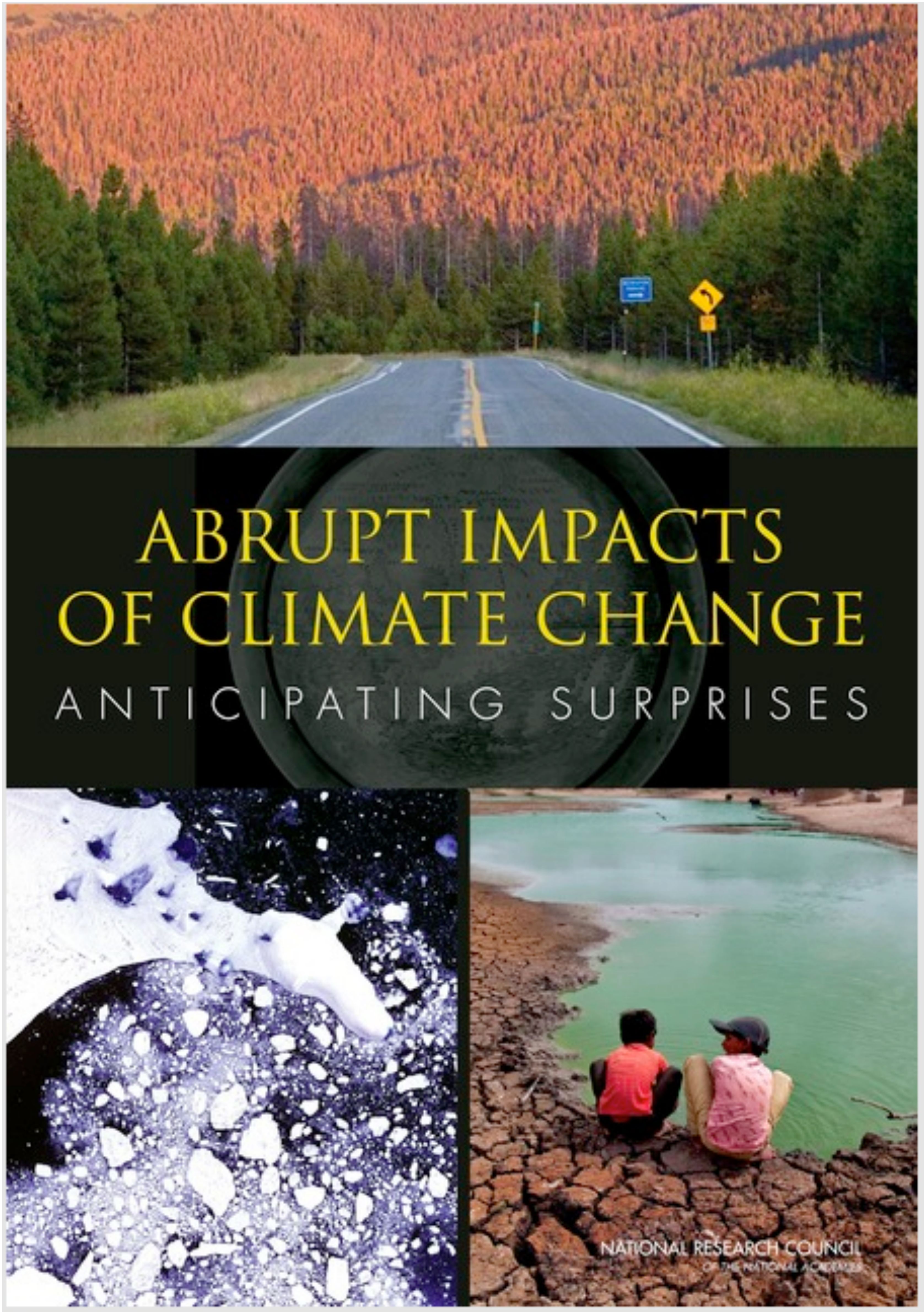
Antarctica: minor contribution

Main contribution: steric changes



Knowledge in Times of Rapid Changes

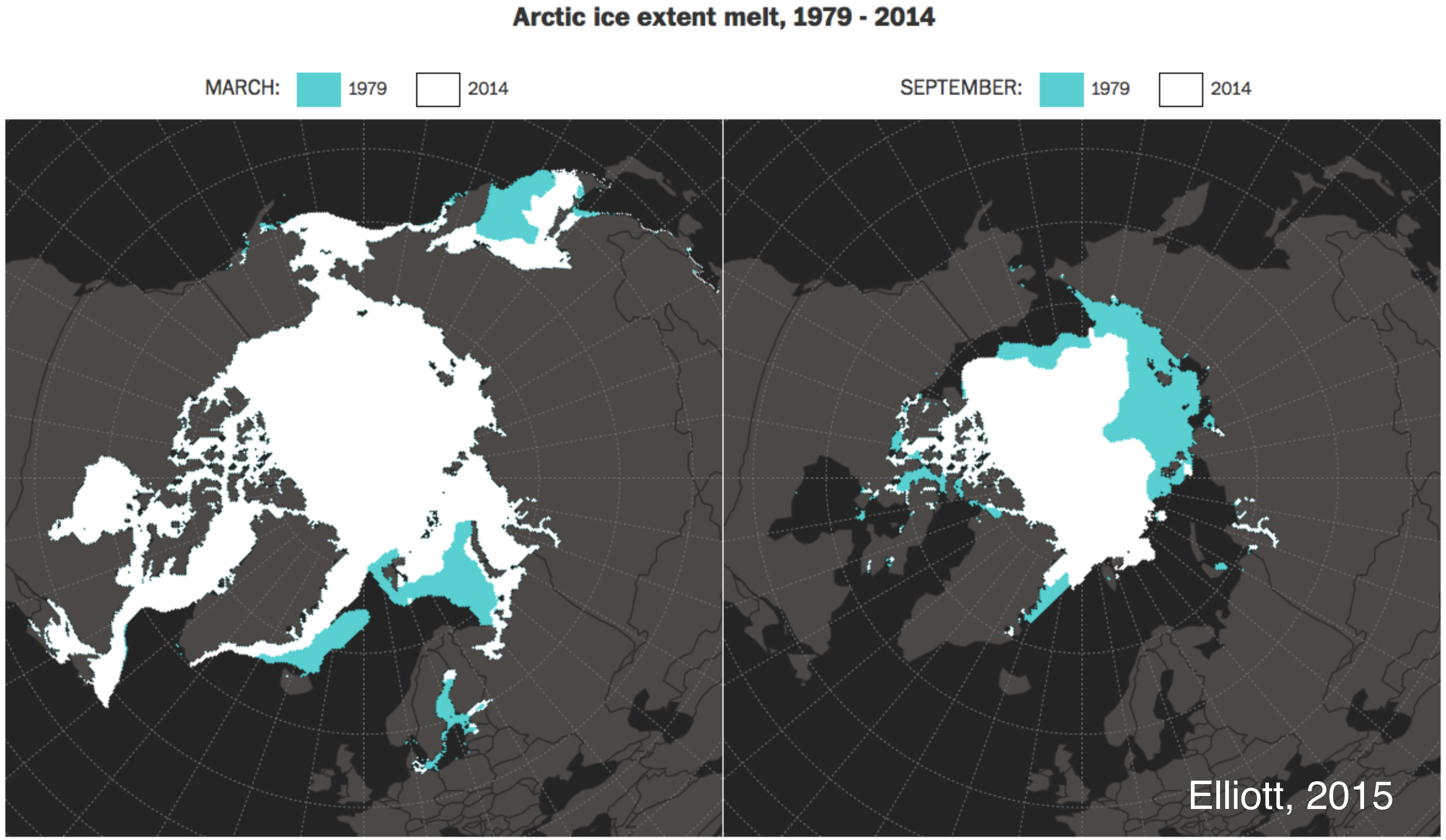
Knowledge in Times of Rapid Changes



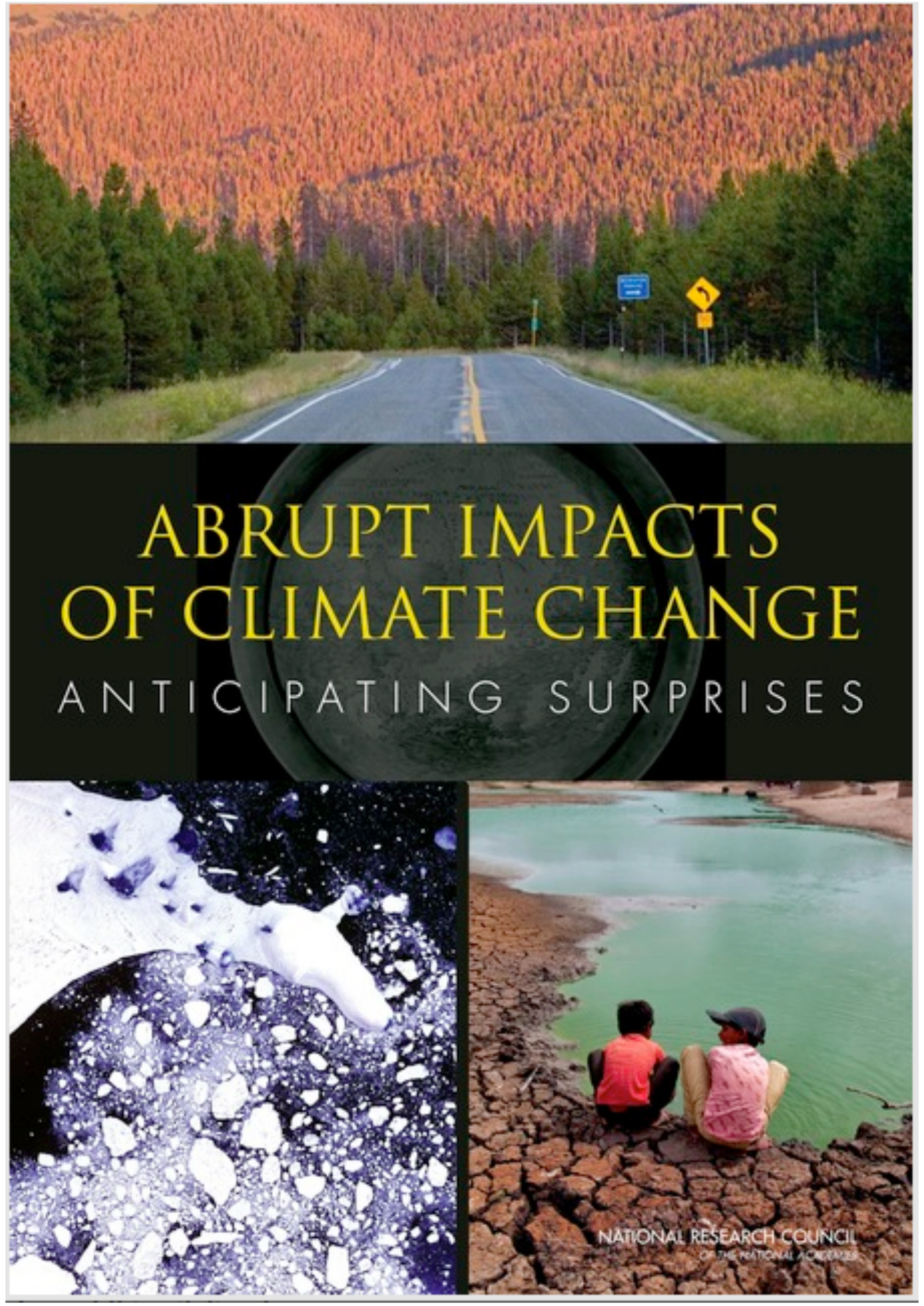
National Research Council in 2013:

There is the potential for surprises and new extremes ...

Already happening: Disappearance of late-summer Arctic sea ice



Knowledge in Times of Rapid Changes

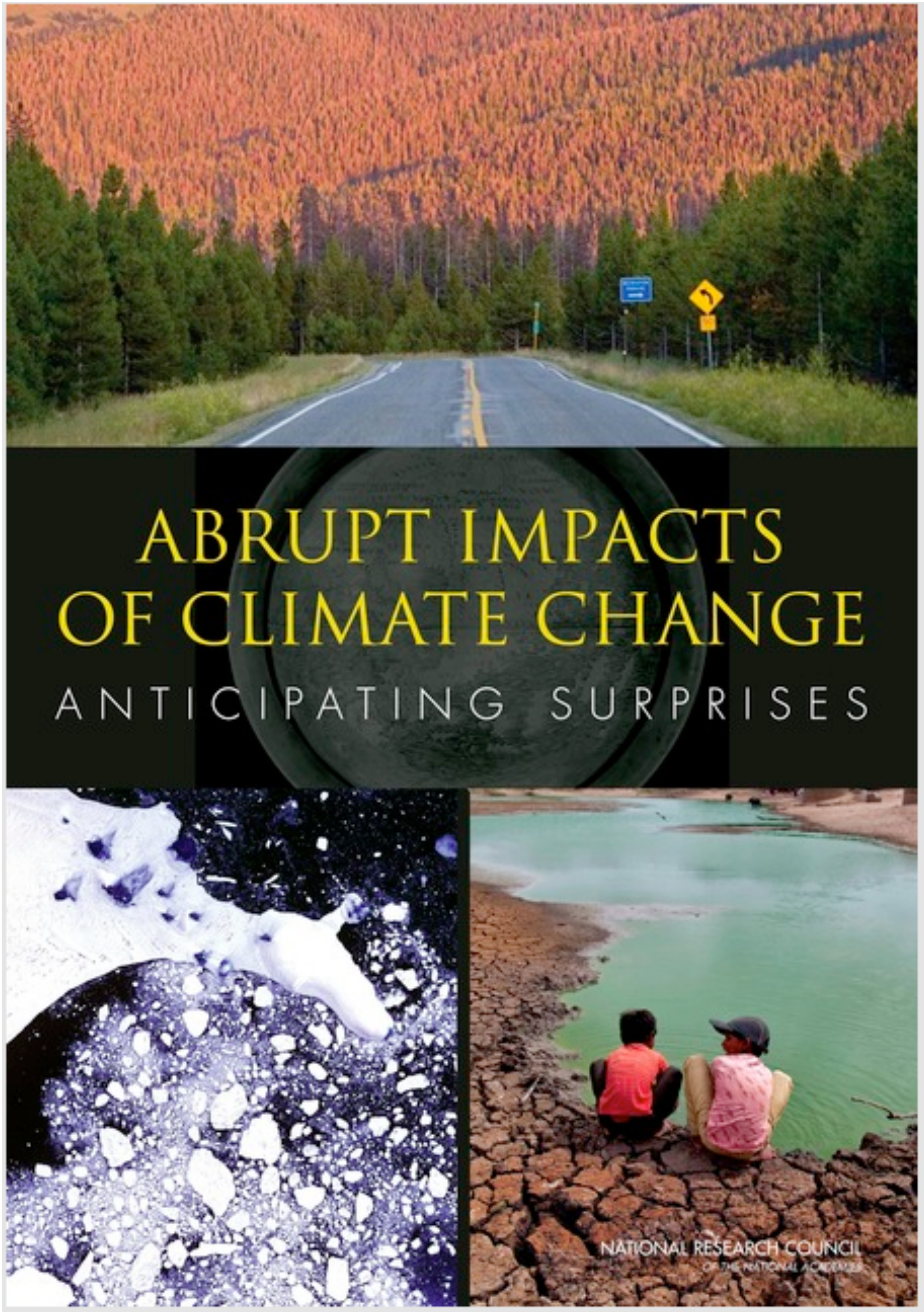


National Research Council in 2013:

There is the potential for surprises and new extremes ...

Already happening: Disappearance of late-summer Arctic sea ice

Knowledge in Times of Rapid Changes

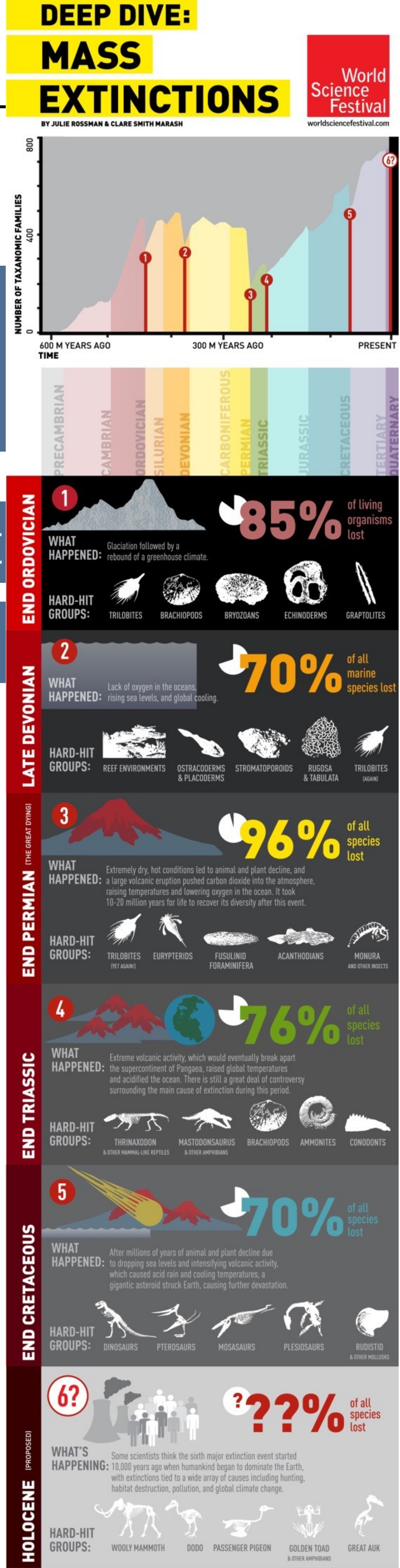


National Research Council in 2013:

There is the potential for surprises and new extremes ...

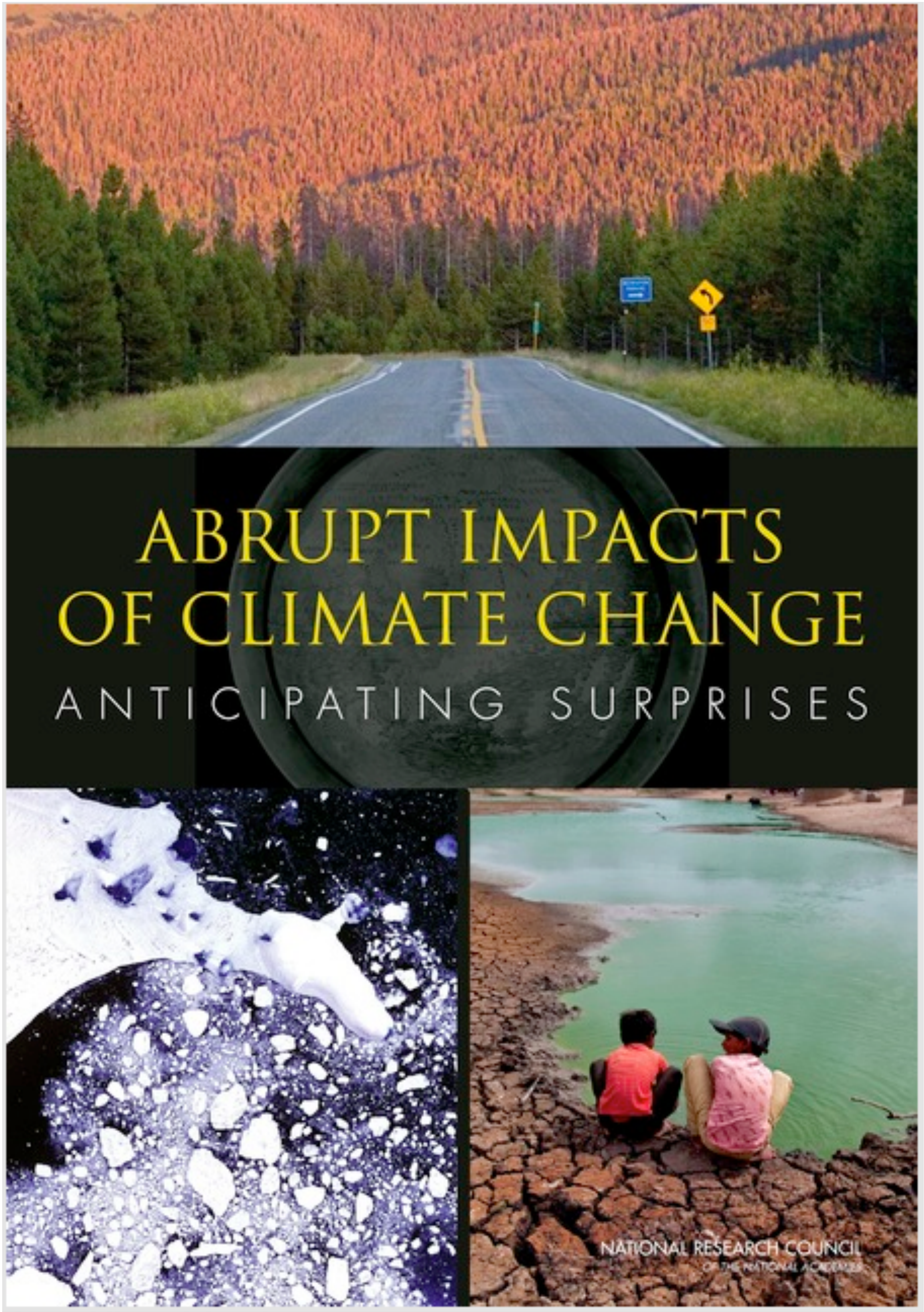
Already happening: Disappearance of late-summer Arct

Already happening: Increases in extinction threats



Rossman&Marash (2014)

Knowledge in Times of Rapid Changes



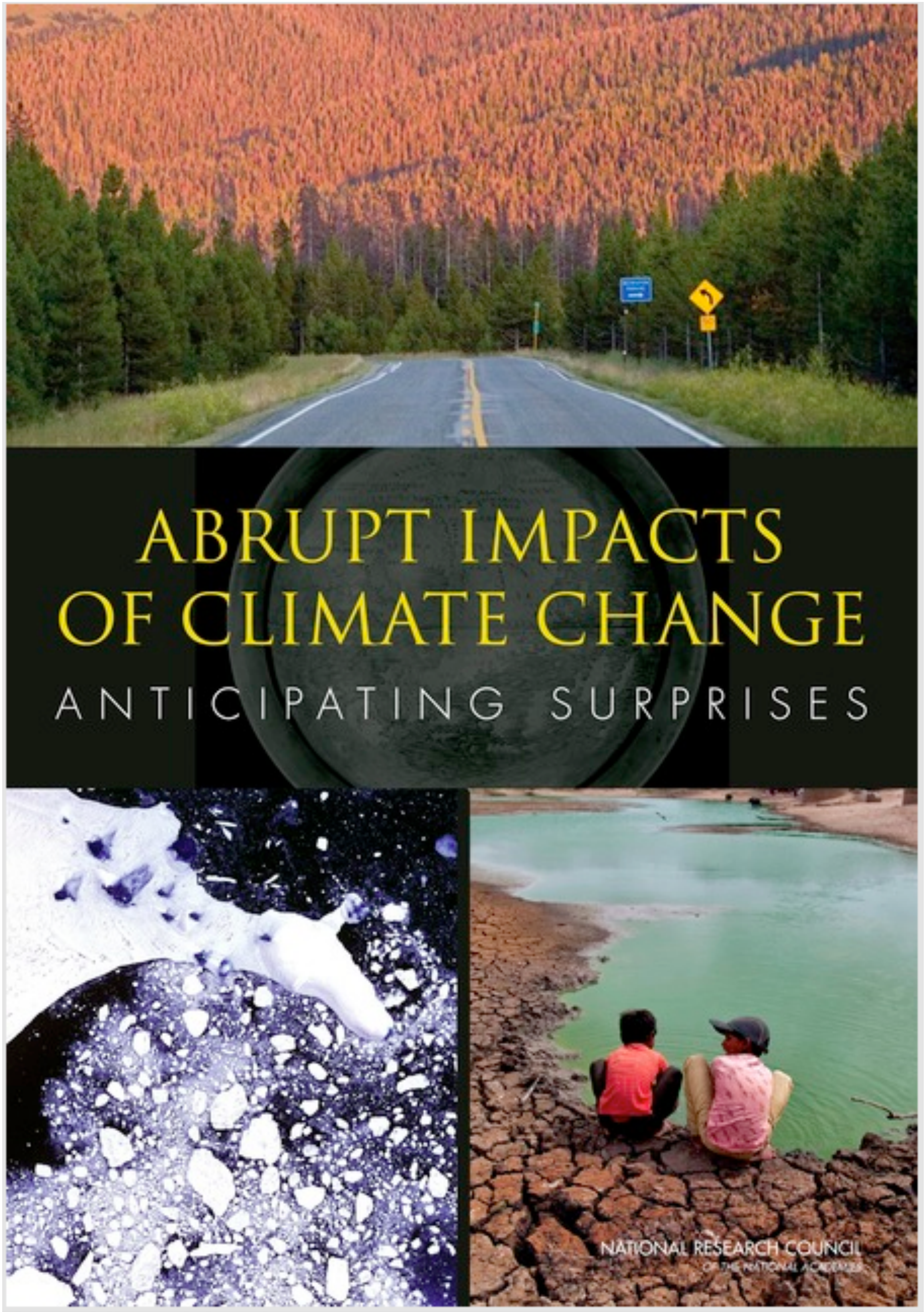
National Research Council in 2013:

There is the potential for surprises and new extremes ...

Already happening: Disappearance of late-summer Arctic sea ice

Already happening: Increases in extinction threats

Knowledge in Times of Rapid Changes



National Research Council in 2013:

There is the potential for surprises and new extremes ...

Already happening: Disappearance of late-summer Arctic sea ice

Already happening: Increases in extinction threats

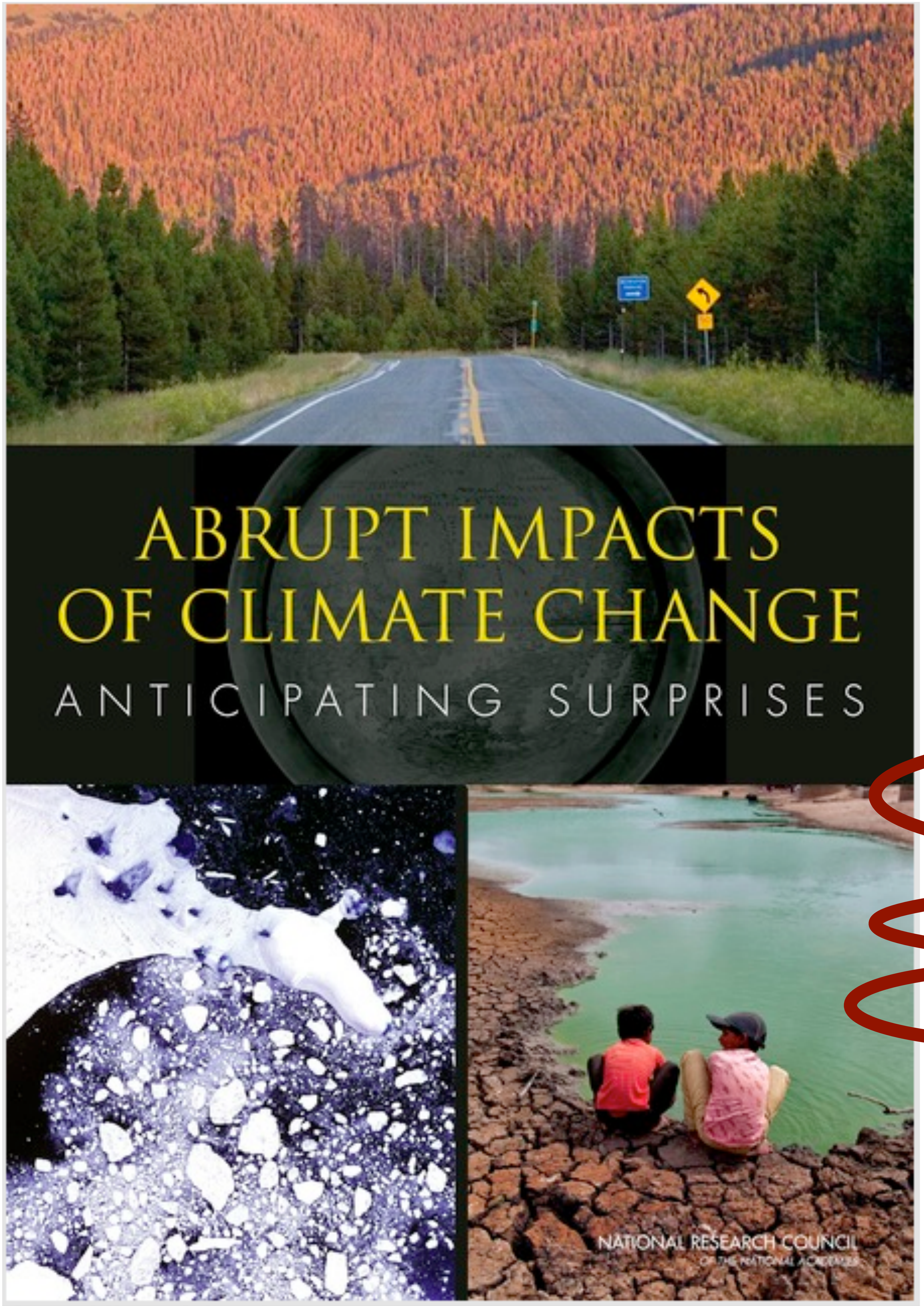
Disruption of Atlantic Meridional Overturning Circulation: unlikely in the 21st century; but gradual chance could have severe consequences

Greenland ice sheet: abrupt changes very unlikely in the 21st century

West Antarctic Ice Sheet: up to 4.8 m sea level rise; abrupt changes unlikely in the 21st century

Most likely (low-probability) rapid impact: ocean acidification

Knowledge in Times of Rapid Changes



National Research Council in 2013:

There is the potential for surprises and new extremes ...

Already happening: Disappearance of late-summer Arctic sea ice

Already happening: Increases in extinction threats

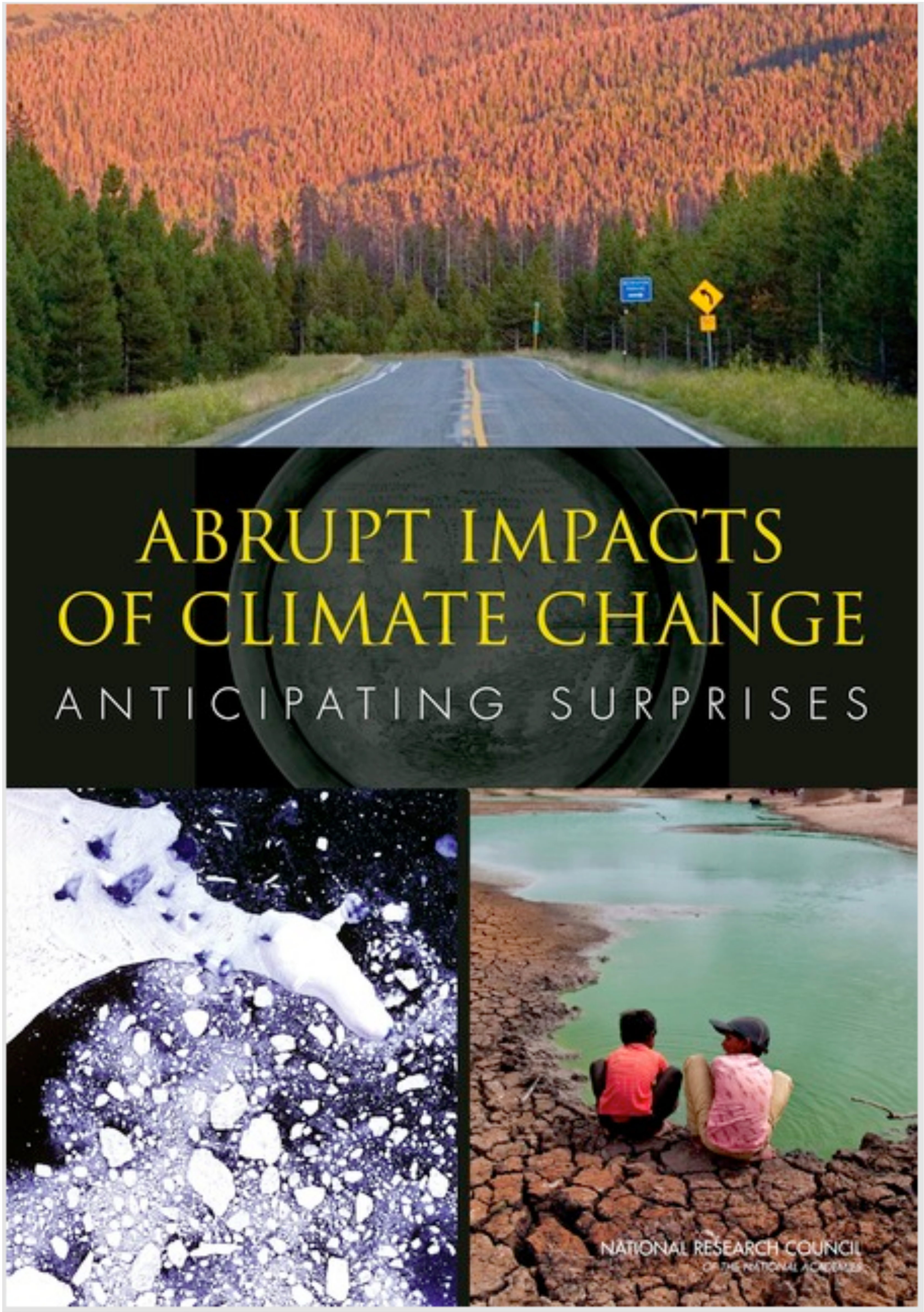
Disruption of Atlantic Meridional Overturning Circulation: unlikely in the 21st century; but gradual chance could have severe consequences

Greenland ice sheet: abrupt changes very unlikely in the 21st century

West Antarctic Ice Sheet: up to 4.8 m sea level rise; abrupt changes unlikely in the 21st century

Most likely (low-probability) rapid impact: ocean acidification

Knowledge in Times of Rapid Changes

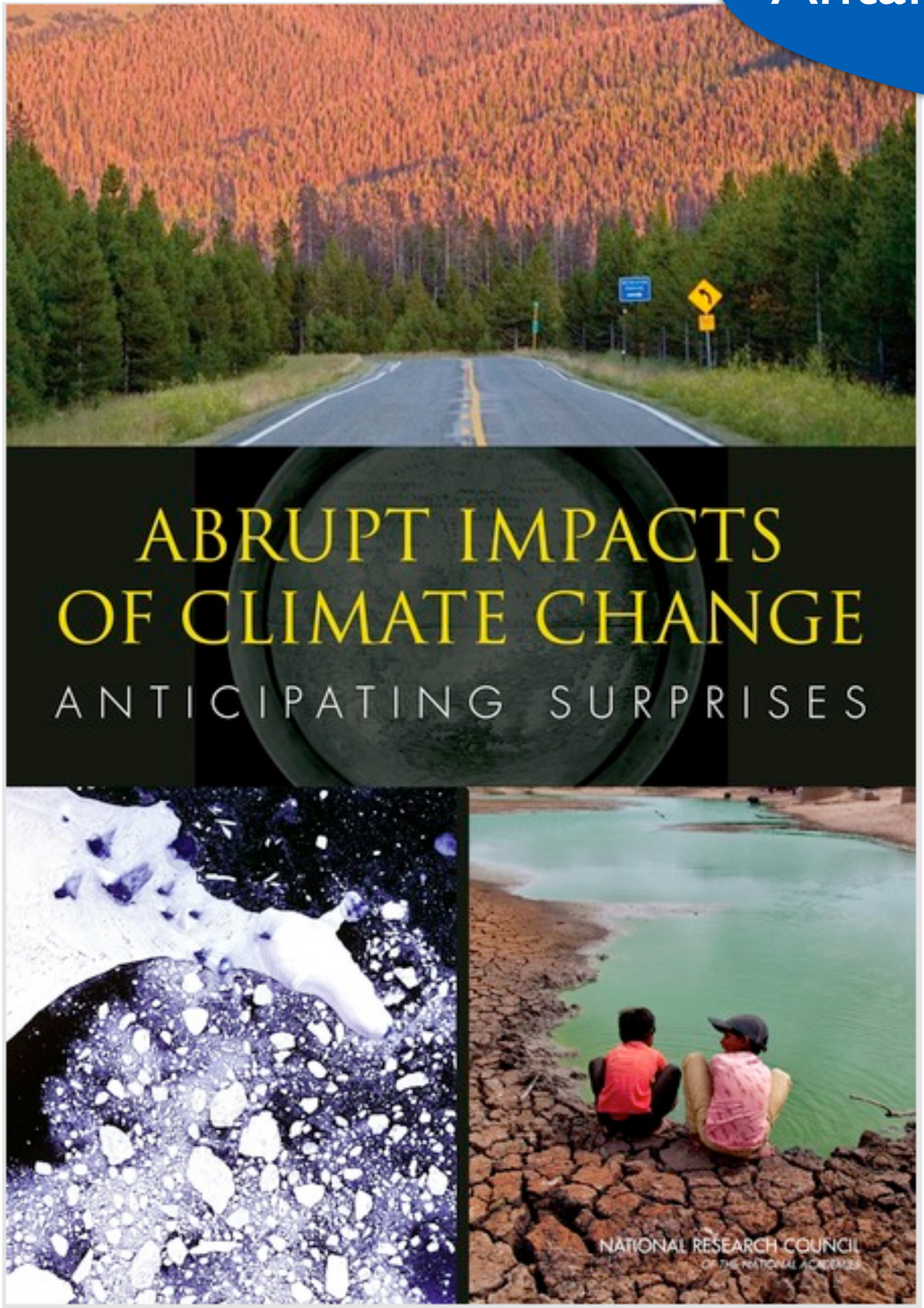


National Research Council in 2013:

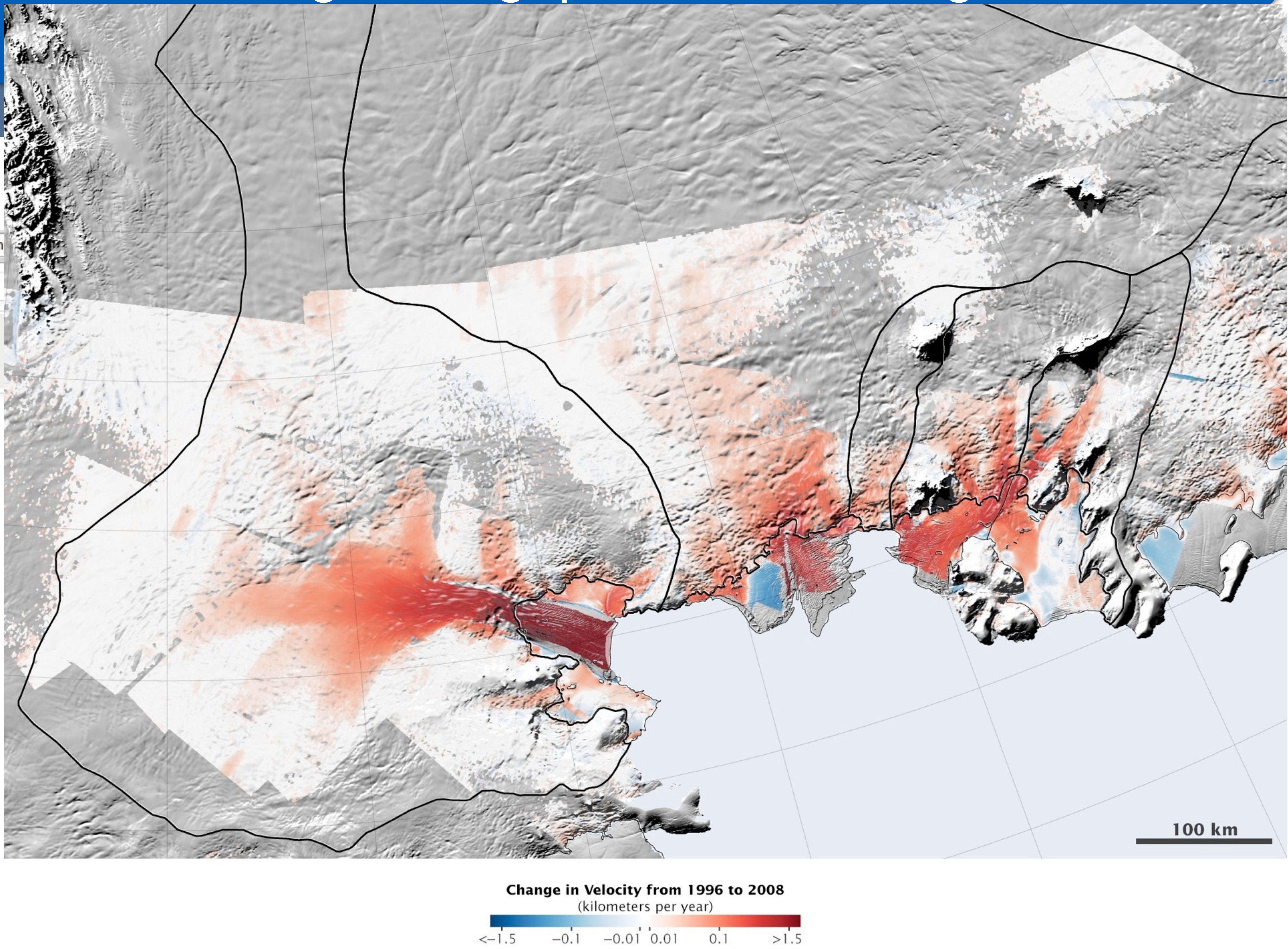
There is the potential for surprises and new extremes ...

Sea Level Rise

Knowledge in Times of R



May 12, 2014: A large section of the mighty West Antarctic ice sheet has begun falling apart ... That's enough ice to raise

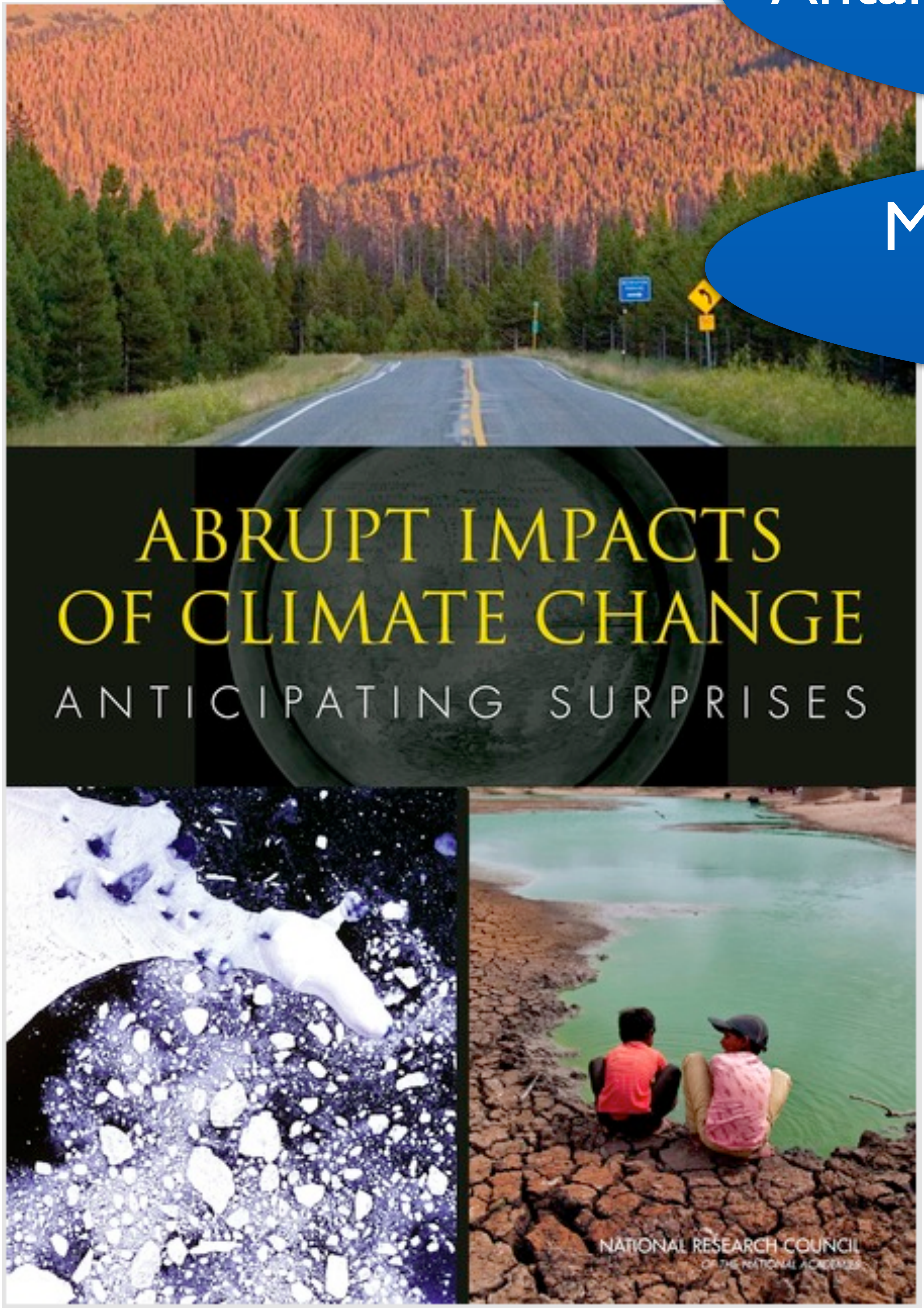


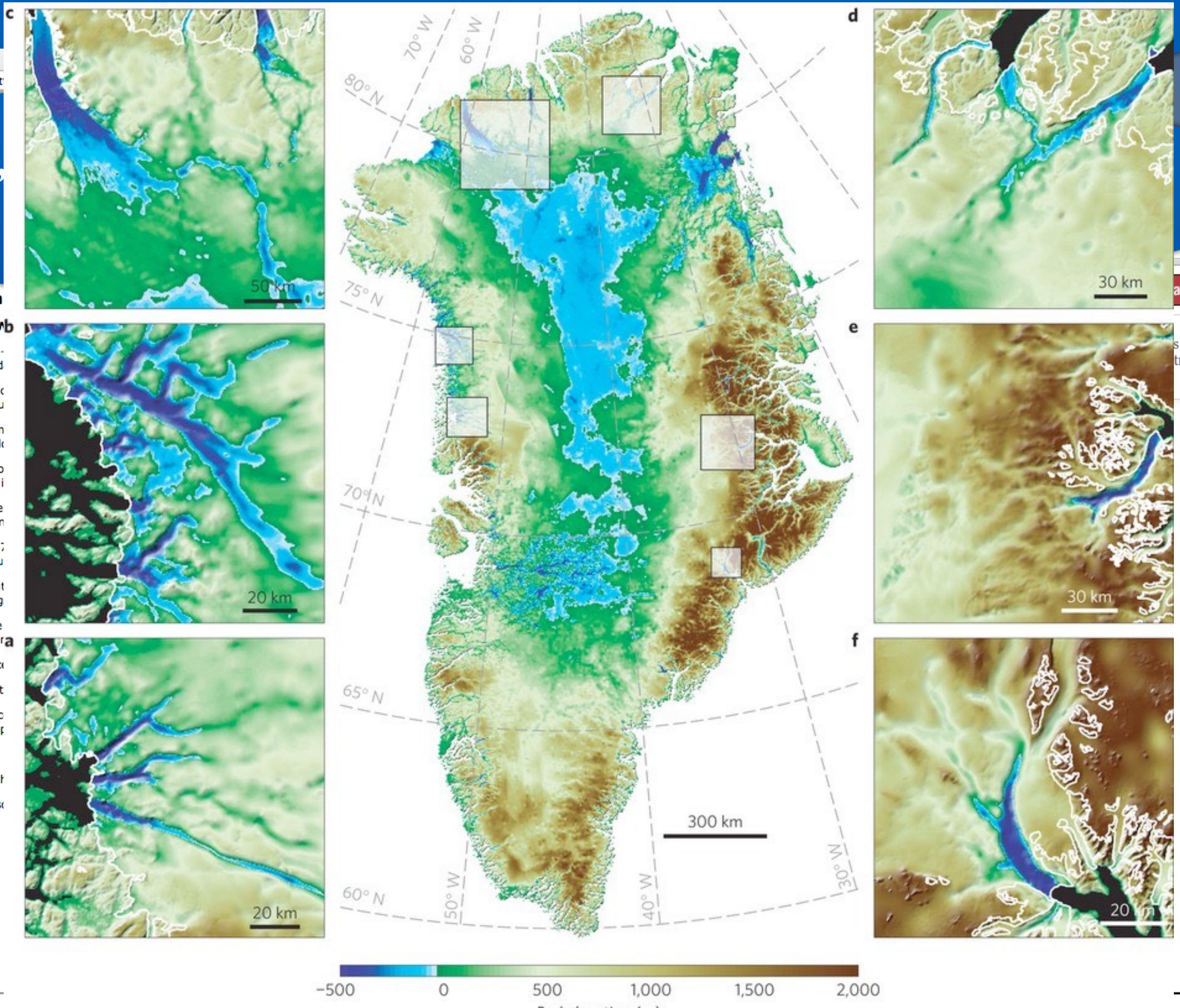
Sea Level Rise

Knowledge in Times of R

May 12, 2014: A large section of the mighty West Antarctic ice sheet has begun falling apart ... That's enough ice to raise

May 18,



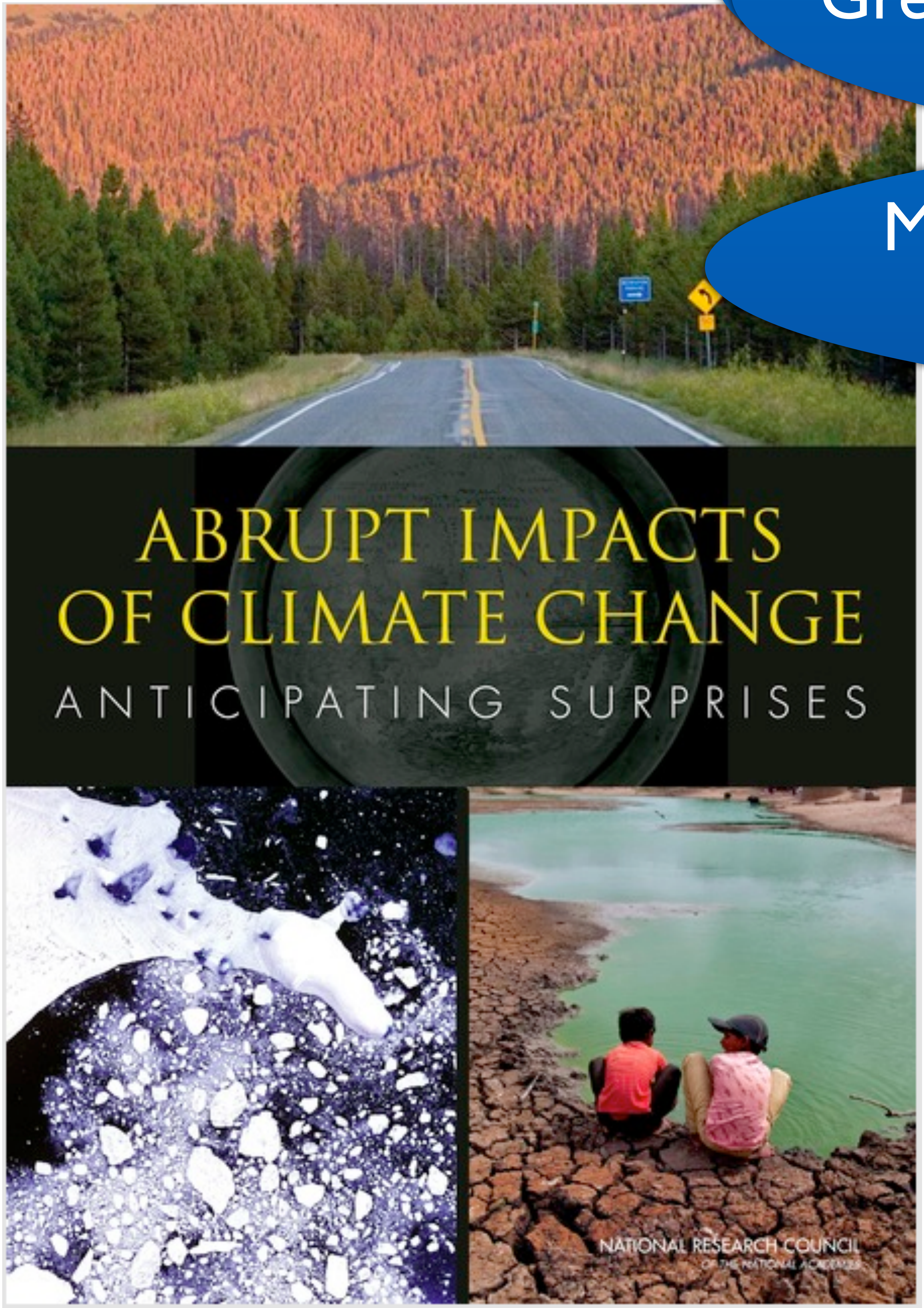


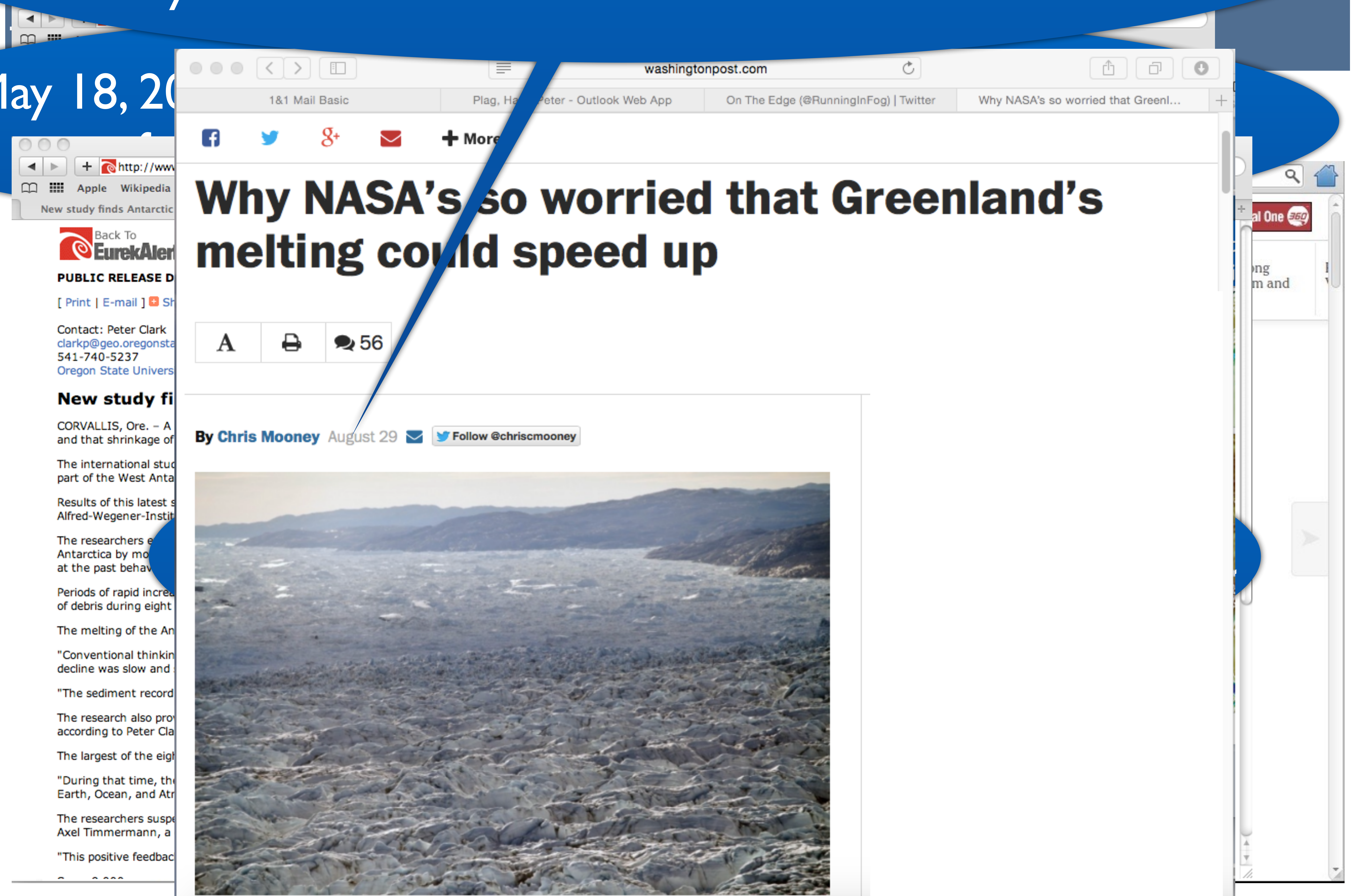
Sea Level Rise

Knowledge in Times of R

August 29, 2015:"The critical question thus becomes: Is Greenland likely to lose even more ice than it's currently losing per year — and could Antarctica do the same?"

May 18, 20

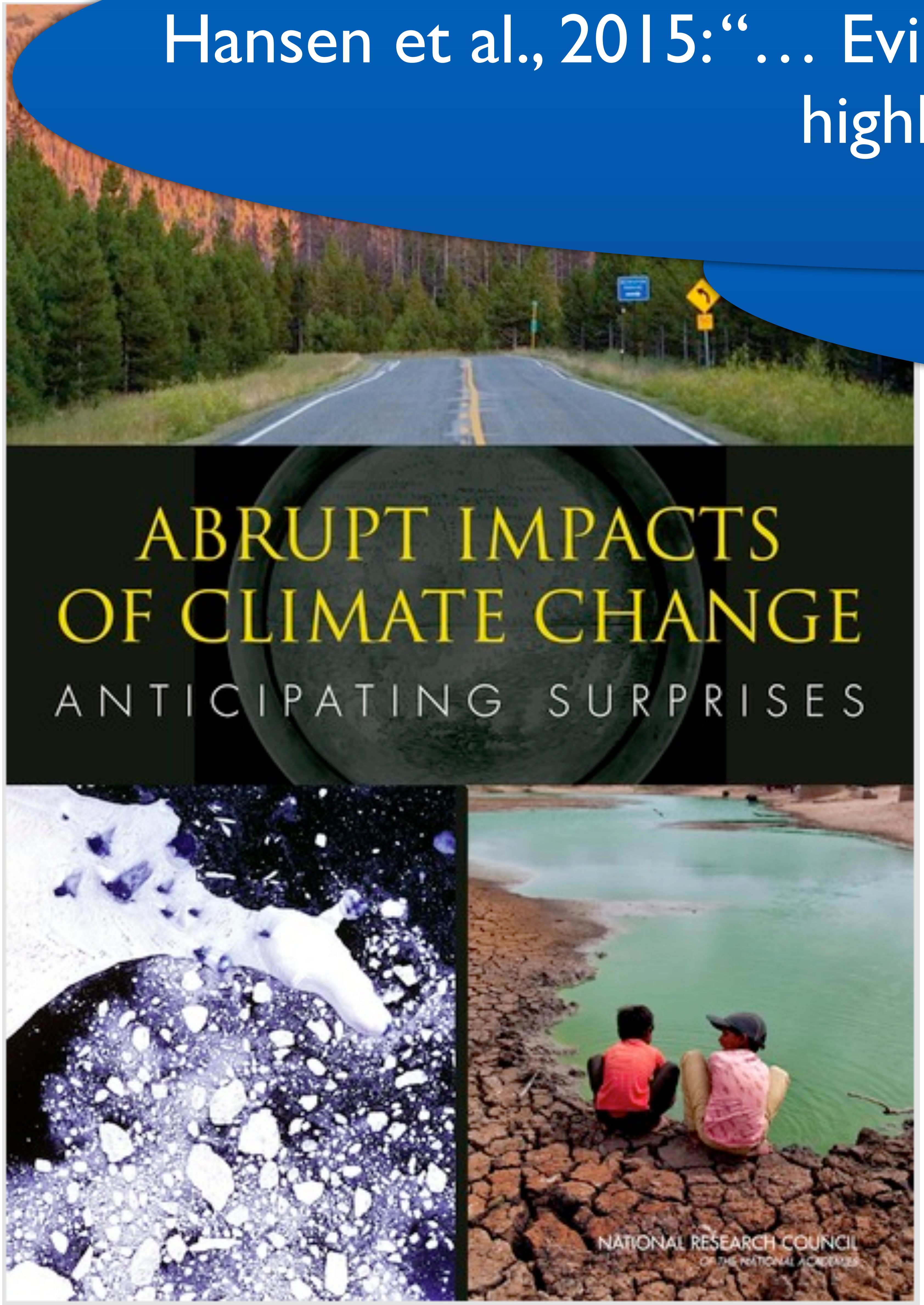




Sea Level Rise

Knowledge in Tim… …2015 “The critical question thus becomes: Is

Hansen et al., 2015: “… Evidence … that 2°C global warming is highly dangerous.”



| EGU Journals | Contact | Imprint |

- About
- Editorial & advisory board
- Articles ACP
- Articles ACPD
  - Papers in open discussion
  - Volumes and issues
  - Special issues
  - Most commented papers
  - Full text search
  - Title and author search
- Highlight articles
- Subscribe to alerts
- Peer review
- For authors
- For reviewers

User ID
Password
New user? | Lost login?

Journal metrics
IF 5.053

Article | Discussion | Metrics | Related Articles

Atmos. Chem. Phys. Discuss., 15, 20059-20179, 2015
www.atmos-chem-phys-discuss.net/15/20059/2015/
doi:10.5194/acpd-15-20059-2015

Research Article 23 Jul 2015

Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2 °C global warming is highly dangerous

Review Status
This discussion paper is under review for the journal Atmospheric Chemistry and Physics (ACP).

J. Hansen[1], M. Sato[1], P. Hearty[2], R. Ruedy[3,4], M. Kelley[3,4], V. Masson-Delmotte[5], G. Russell[4], G. Tselioudis[4], J. Cao[6], E. Rignot[7,8], I. Velicogna[7,8], E. Kandiano[9], K. von Schuckmann[10], P. Kharecha[1,4], A. N. Legrande[4], M. Bauer[11], and K.-W. Lo[3,4]

[1]Climate Science, Awareness and Solutions, Columbia University Earth Institute, New York, NY 10115, USA
[2]Department of Environmental Studies, University of North Carolina at Wilmington, North Carolina 28403, USA
[3]Trinnovium LLC, New York, NY 10025, USA
[4]NASA Goddard Institute for Space Studies, 2880 Broadway, New York, NY 10025, USA
[5]Institut Pierre Simon Laplace, Laboratoire des Sciences du Climat et de l'Environnement (CEA-CNRS-UVSQ), Gif-sur-Yvette, France
[6]Key Lab of Aerosol Chemistry & Physics, Institute of Earth Environment, Chinese Academy of Sciences, Xi'an 710075, China
[7]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, 91109, USA
[8]Department of Earth System Science, University of California, Irvine, California, 92697, USA
[9]GEOMAR, Helmholtz Centre for Ocean Research, Wischhofstrasse 1–3, Kiel 24148, Germany
[10]Mediterranean Institute of Oceanography, University of Toulon, La Garde, France
[11]Department of Applied Physics and Applied Mathematics, Columbia University, New York, NY, 10027, USA

Received: 11 Jun 2015 – Accepted: 09 Jul 2015 – Published: 23 Jul 2015

Abstract. There is evidence of ice melt, sea level rise to +5–9 m, and extreme storms in the prior interglacial period that was less than 1 °C warmer than today. Human-made climate forcing is stronger and more rapid than paleo forcings, but much can be learned by combining insights from

Search ACPD
Search
Full Text

Discussion Paper
- Supplement (2719 KB)

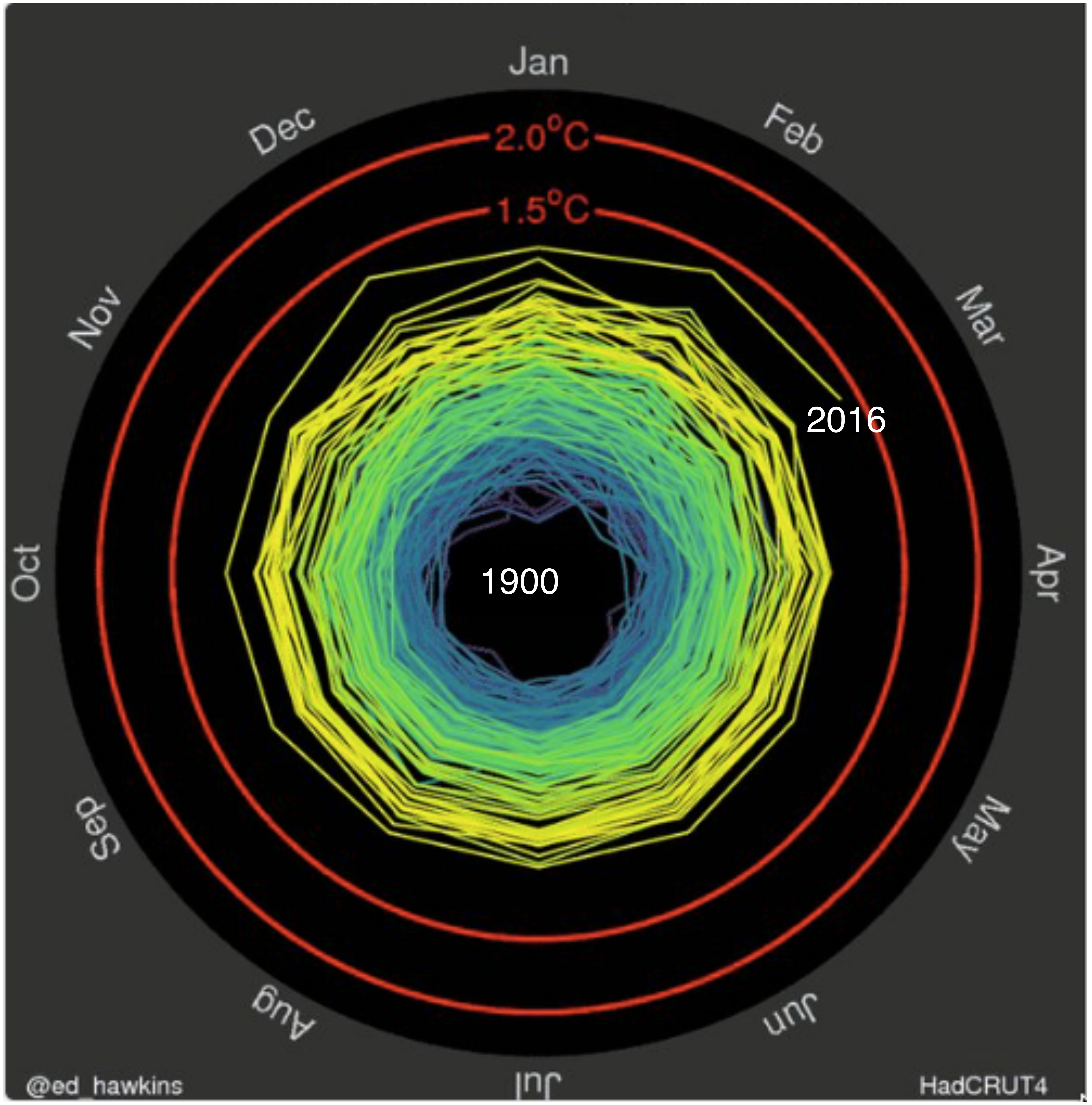
PDF
FULL-TEXT XML

Citation
- BibTeX
- EndNote

Share

Sea Level Rise

Sea Level Rise



Sea Level Rise

The Washington Post

Energy and Environment

Scientists find more reasons that Greenland will melt faster

By Chris Mooney April 30

Photograph of Torsukatat Avannarleq, a tidewater glacier in West Greenland, with 2 visible sediment plumes at its terminus. These plumes are made up of

The Washington Post

Energy and Environment

Dominoes fall: Vanishing Arctic ice shifts jet stream, which melts Greenland glaciers

By Chelsea Harvey May 2

Iceberg, with Mount Dundas in the background, Qaasuitsup, west Greenland, Denmark. (Photo by DeAgostini/Getty Images)

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?

Example of Sea Level Rise

Accepted knowledge in 2000:

Greenland: no significant contribution to sea level rise

Antarctica: minor contribution

Main contribution: steric changes

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?

Example of Sea Level Rise

Accepted knowledge in 2000:

Greenland: no significant contribution to sea level rise

Antarctica: minor contribution

Main contribution: steric changes

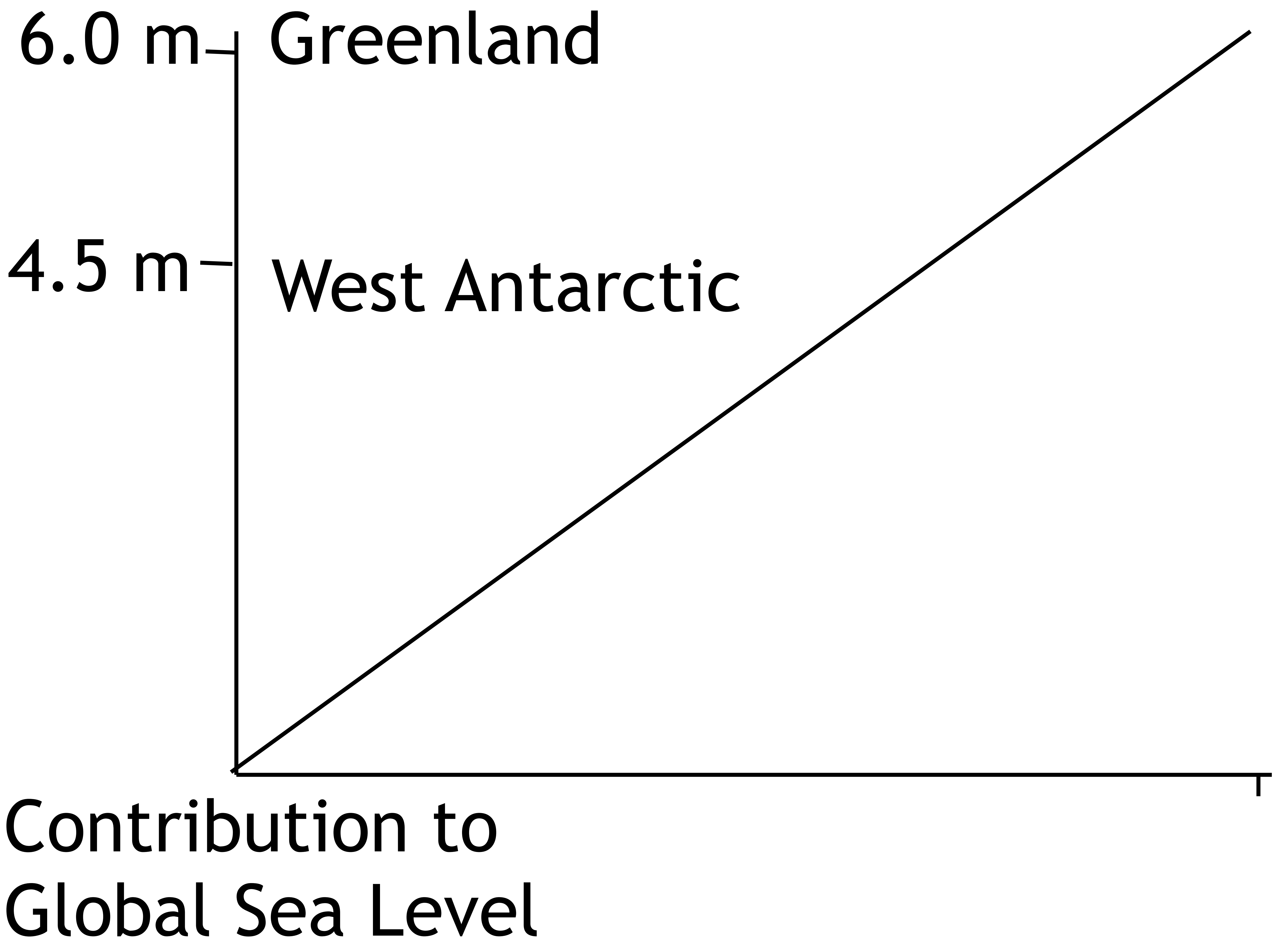
Knowledge in 2016:

Greenland: is contributing, is accelerating; increasing potential for a large contribution to sea level rise due to deep warm water around Greenland and impact of changes in atmospheric circulation.

Antarctica: West Antarctic ice sheet (WAIS) will contribute 4.5 m

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?



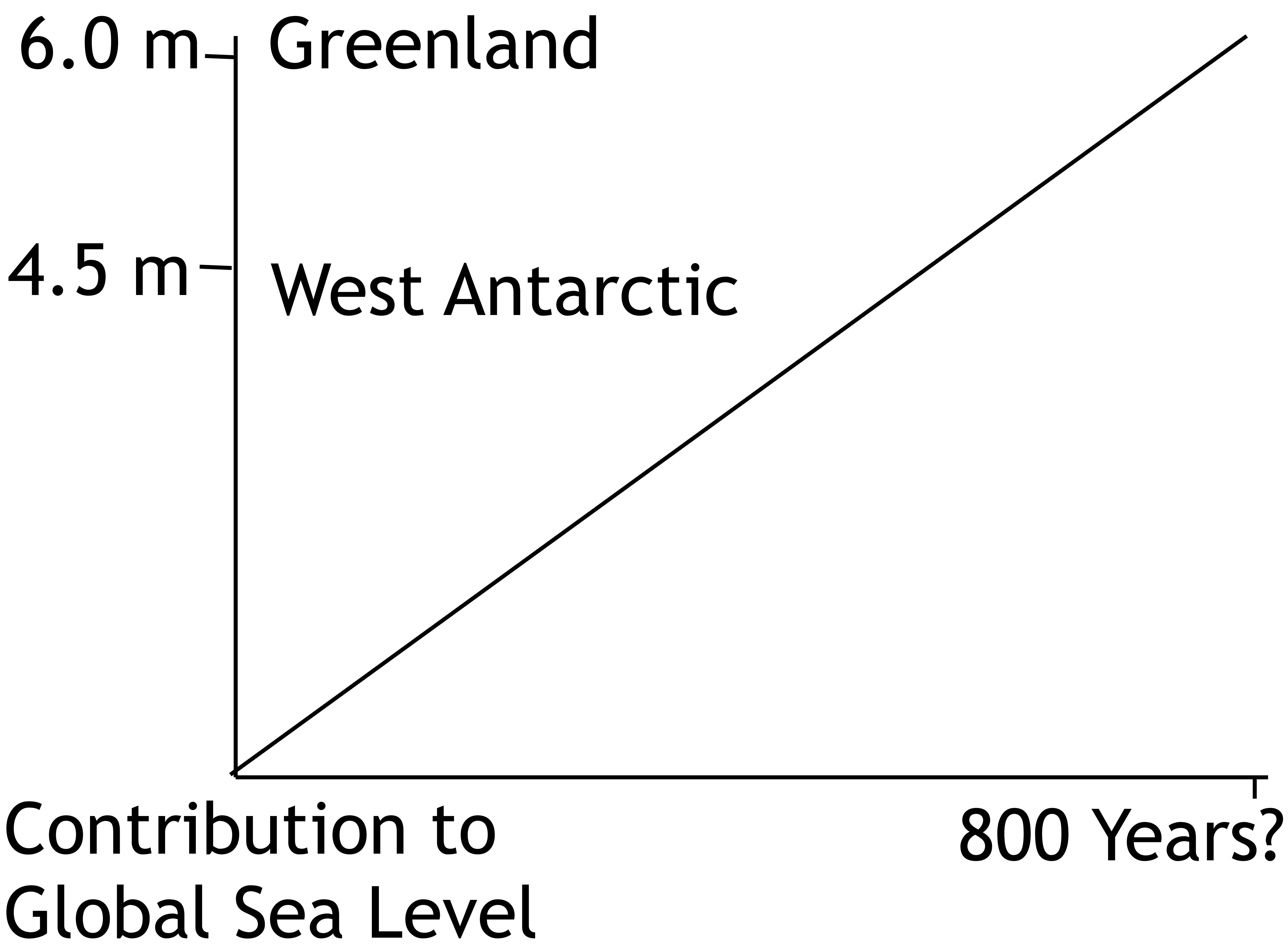
Example of Sea Level Rise

Accepted knowledge in 2000:
Greenland: no significant contribution to sea level rise
Antarctica: minor contribution
Main contribution: steric changes

Knowledge in 2016:
Greenland: is contributing, is accelerating; increasing potential for a large contribution to sea level rise due to deep warm water around Greenland and impact of changes in atmospheric circulation.
Antarctica: West Antarctic ice sheet (WAIS) will contribute 4.5 m

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?



Example of Sea Level Rise

Accepted knowledge in 2000:

Greenland: no significant contribution to sea level rise

Antarctica: minor contribution

Main contribution: steric changes

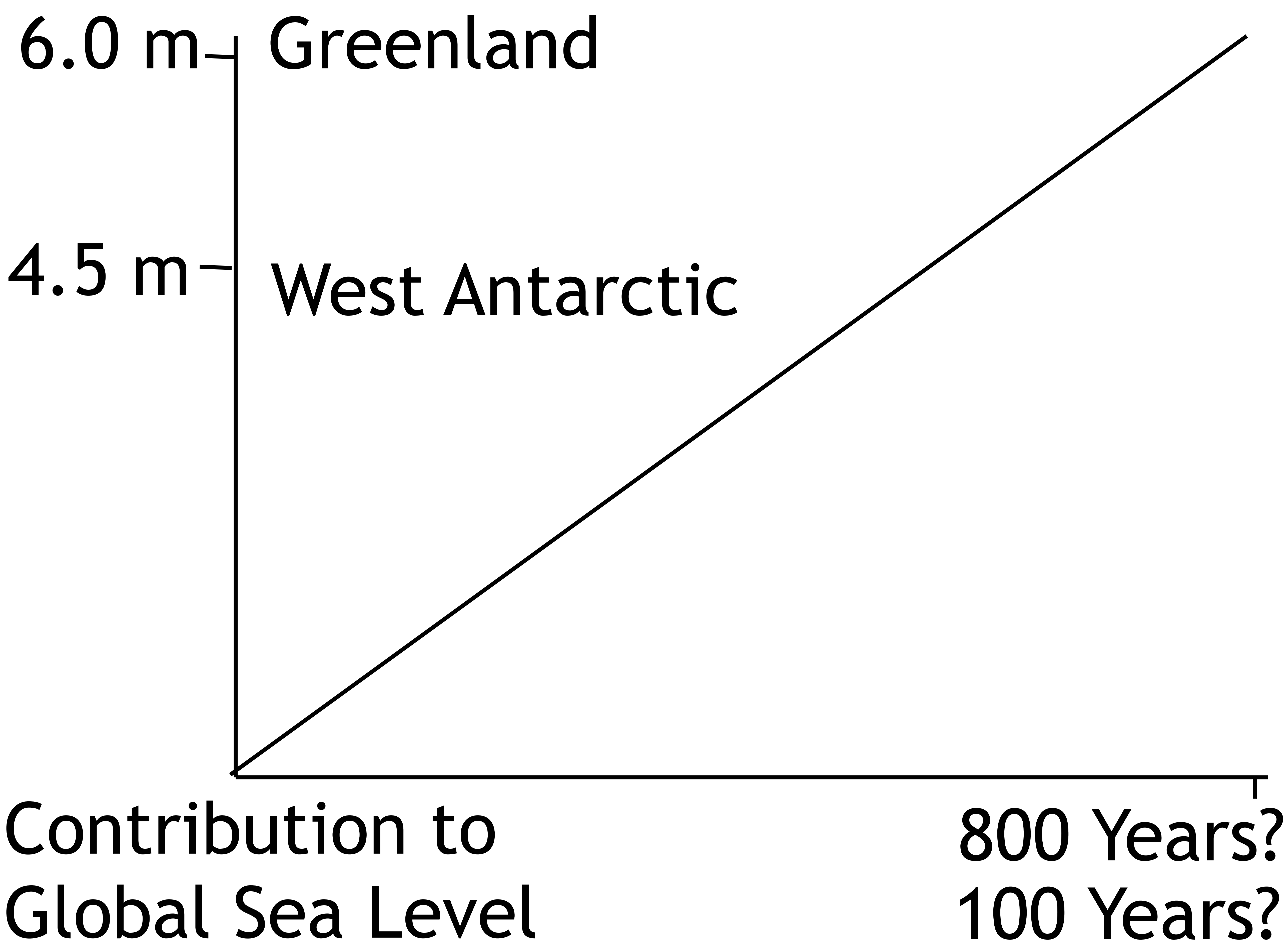
Knowledge in 2016:

Greenland: is contributing, is accelerating; increasing potential for a large contribution to sea level rise due to deep warm water around Greenland and impact of changes in atmospheric circulation.

Antarctica: West Antarctic ice sheet (WAIS) will contribute 4.5 m

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?



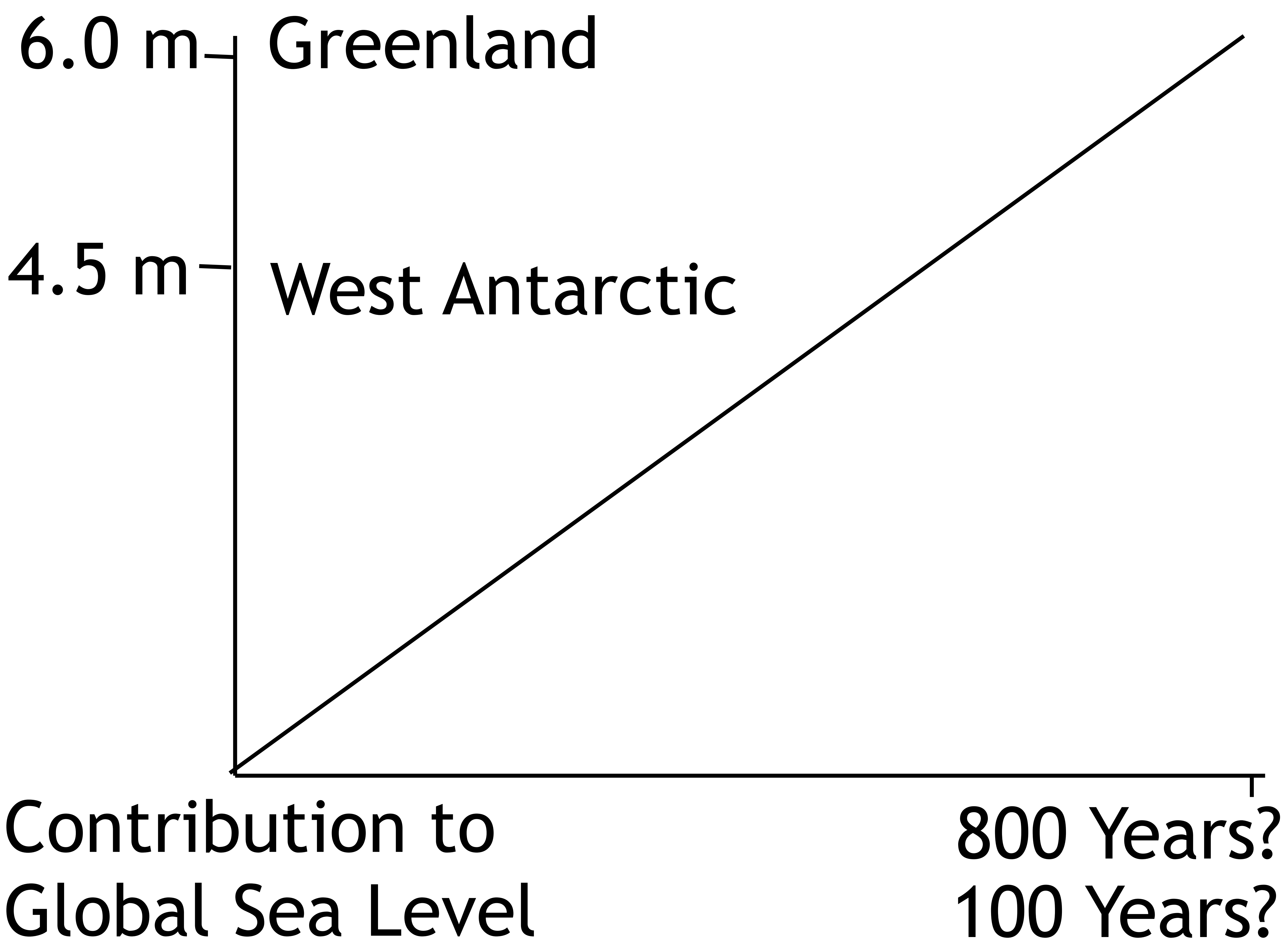
Example of Sea Level Rise

Accepted knowledge in 2000:
Greenland: no significant contribution to sea level rise
Antarctica: minor contribution
Main contribution: steric changes

Knowledge in 2016:
Greenland: is contributing, is accelerating; increasing potential for a large contribution to sea level rise due to deep warm water around Greenland and impact of changes in atmospheric circulation.
Antarctica: West Antarctic ice sheet (WAIS) will contribute 4.5 m

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?



Example of Sea Level Rise

Accepted knowledge in 2000:

Greenland: no significant contribution to sea level rise

Antarctica: minor contribution

Main contribution: steric changes

Knowledge in 2016:

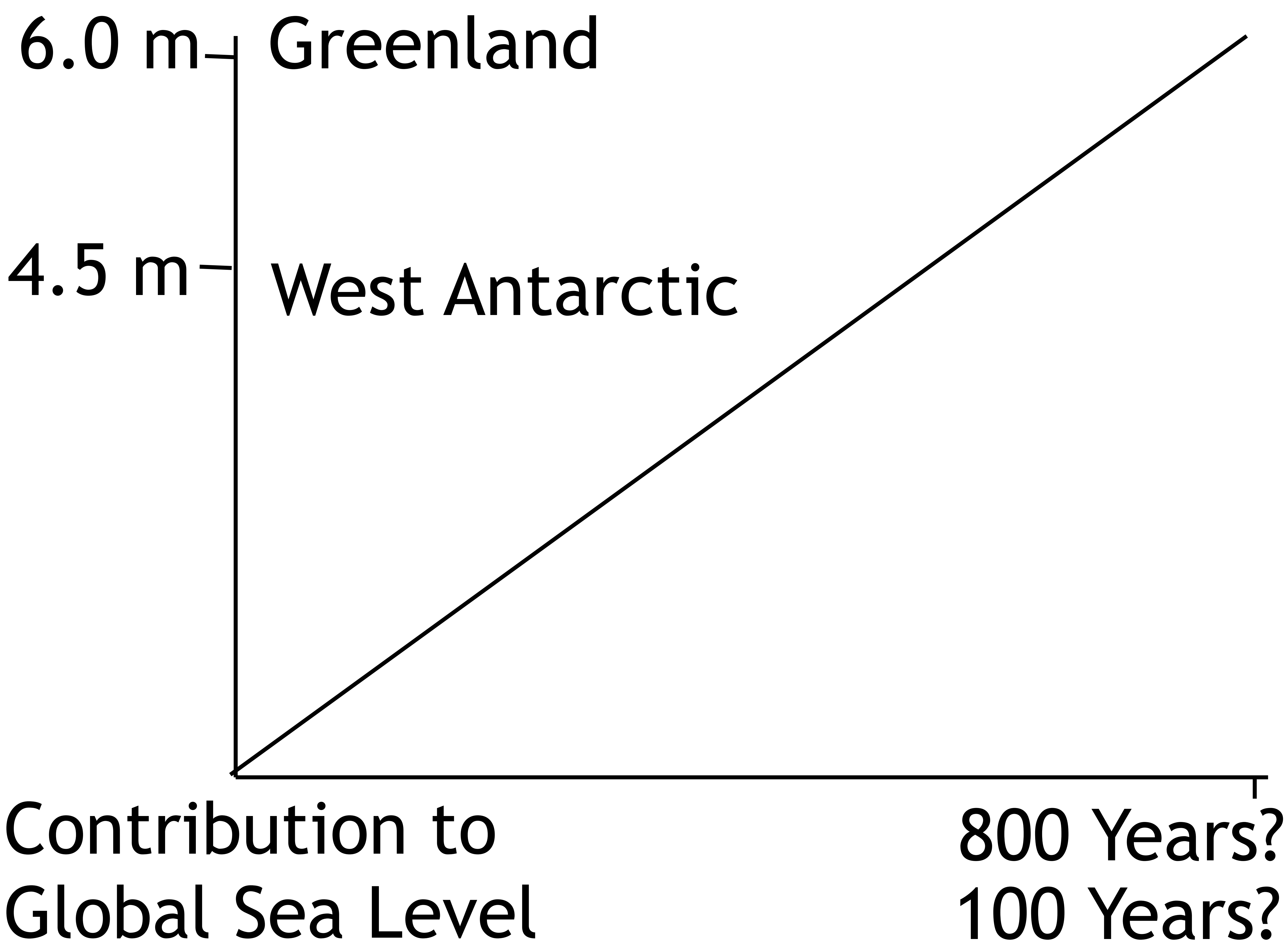
Greenland: is contributing, is accelerating; increasing potential for a large contribution to sea level rise due to deep warm water around Greenland and impact of changes in atmospheric circulation.

Antarctica: West Antarctic ice sheet (WAIS) will contribute 4.5 m

How worried should we be?

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?



Example of Sea Level Rise

Accepted knowledge in 2000:

Greenland: no significant contribution to sea level rise

Antarctica: minor contribution

Main contribution: steric changes

Knowledge in 2016:

Greenland: is contributing, is accelerating; increasing potential for a large contribution to sea level rise due to deep warm water around Greenland and impact of changes in atmospheric circulation.

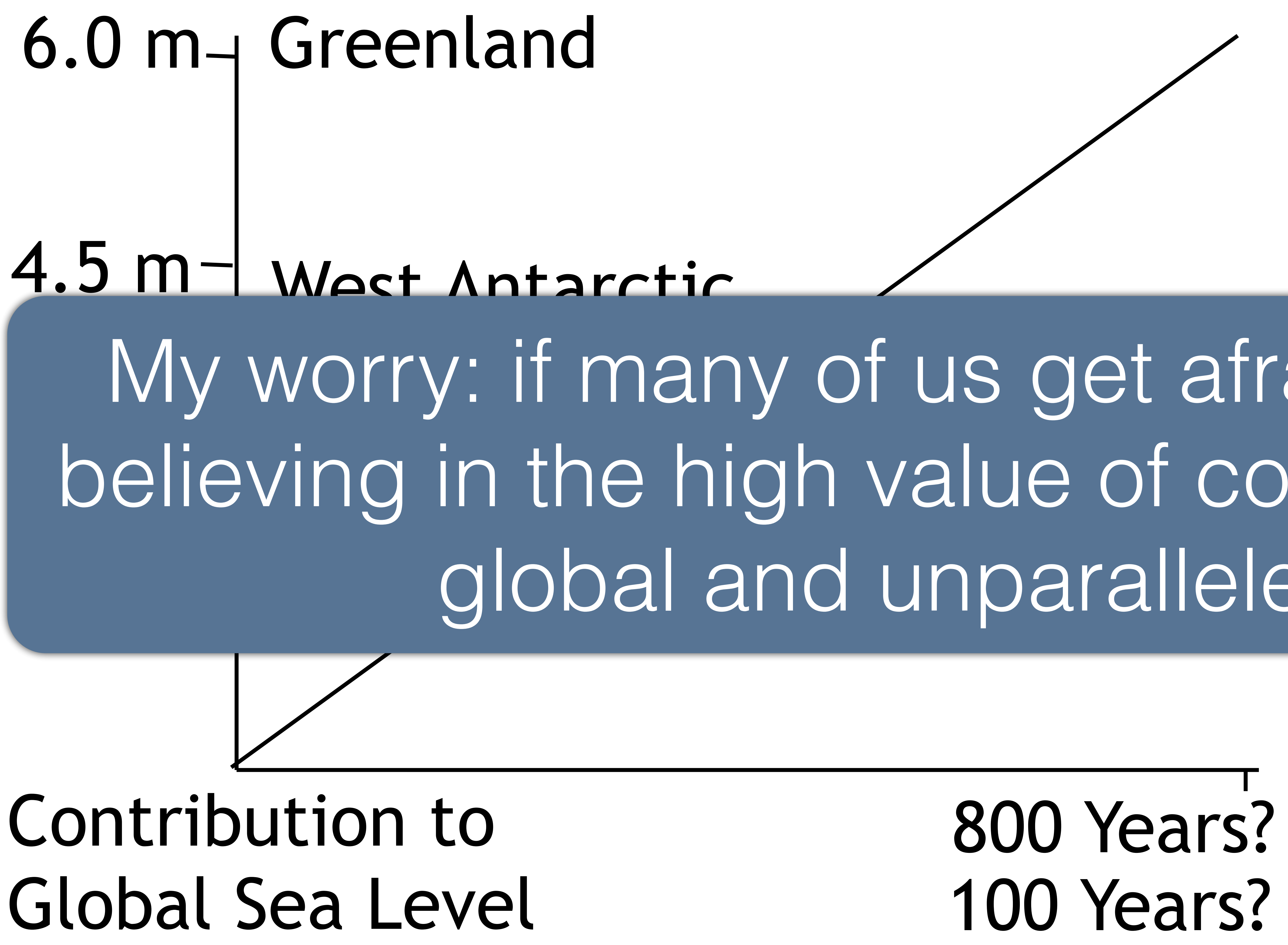
Antarctica: West Antarctic ice sheet (WAIS) will contribute 4.5 m

How worried should we be?

What should we be worried about?

Knowledge in Times of Rapid Changes

How Solid is our Knowledge?



Example of Sea Level Rise

Accepted knowledge in 2000:

Greenland: no significant contribution to sea level rise

Antarctica: minor contribution

Main contribution: steric changes

Knowledge in 2016:

Greenland: is contributing, is accelerating;

My worry: if many of us get afraid of sea level rise and stop believing in the high value of coastal real estate, we will see a global and unparalleled economic bubble

How worried should we be?

What should we be worried about?

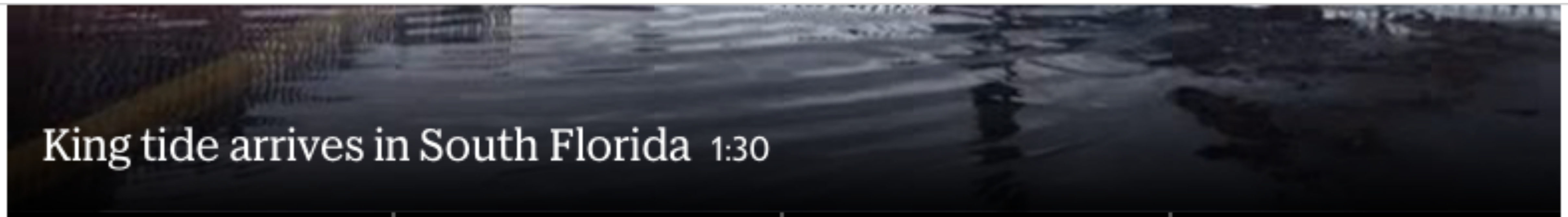
Sea Level Rise

Sea Level Rise

Miami Herald
82°
Sign In | Subscribe
FULL MENU NEWS SPORTS BUSINESS REAL ESTATE

King tide arrives in South Florida 1:30

FACEBOOK TWITTER EMAIL SHARE



King tide arrives in South Florida 1:30

FACEBOOK TWITTER EMAIL SHARE

The annual king tides are rising in South Florida, causing some flooding in coastal areas. **Joey Flechas** - jflechas@miamiherald.com

MIAMI-DADE COUNTY

JUNE 09, 2017 7:45 AM

Mainland Miami ponders returning neighborhoods to nature in order to survive rising seas

BY DAVID SMILEY
dsmiley@miamiherald.com

On mainland Miami, miles away from the pumps that keep Biscayne Bay from slowly swallowing South Beach, the neighborhood around Ray Chasser's riverfront house sometimes seems like it's drowning one high tide at a time.

When the moon is full and the bay bloated, a salty soup comes seeping forth from French drains and onto the streets, turning the low-lying peninsula where the southeast corner of Shorecrest meets the mouth of the Little River into a temporary tide pool. During the annual King Tide, when the water level is at its peak, the coastal community floods for days, something Chasser says didn't happen when he first acquired his property 30 years ago.

"As soon as the tide starts coming up, you can see it coming from the drains. And then the streets are covered," he said. "And it's going to get worse."

Sea Level Rise

Energy flows determine flows in the Water Cycle …

A warming ocean and a warning atmosphere can cause rapid ice melts and increase sea level

Sea Level Rise

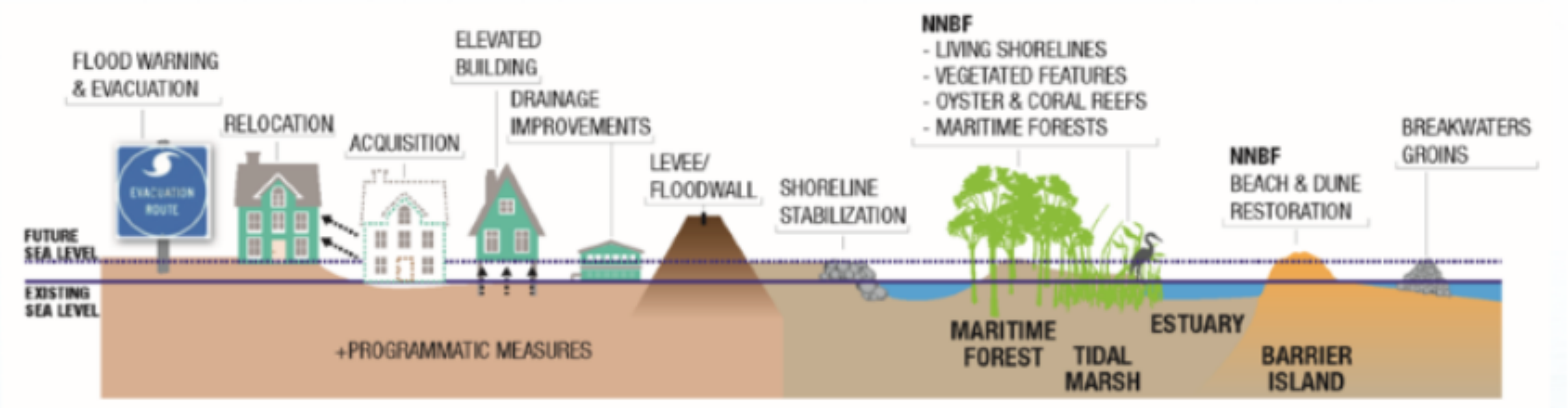
US Army Corps of Engineers

Search Norfolk District

ABOUT BUSINESS WITH US MISSIONS CAREERS MEDIA LIBRARY CONTACT LOCATIONS

HOME > ABOUT > PROJECTS > NORFOLK COASTAL STORM RISK MANAGEMENT

Norfolk Coastal Storm Risk Management



Background

As a result of Hurricane Sandy in October 2012, Congress passed P.L. 113-2, a portion of which directed actions USACE was to take, including preparation of two interim reports to Congress, a project performance evaluation report, and a comprehensive study to address the flood risks of vulnerable coastal populations in areas affected by Hurricane Sandy within the boundaries of the North Atlantic Division of the U.S. Army Corps of Engineers.

Project News

Public Meeting at
Lambert's Point Community Center
1251 W 42nd St.
Norfolk, VA 23508

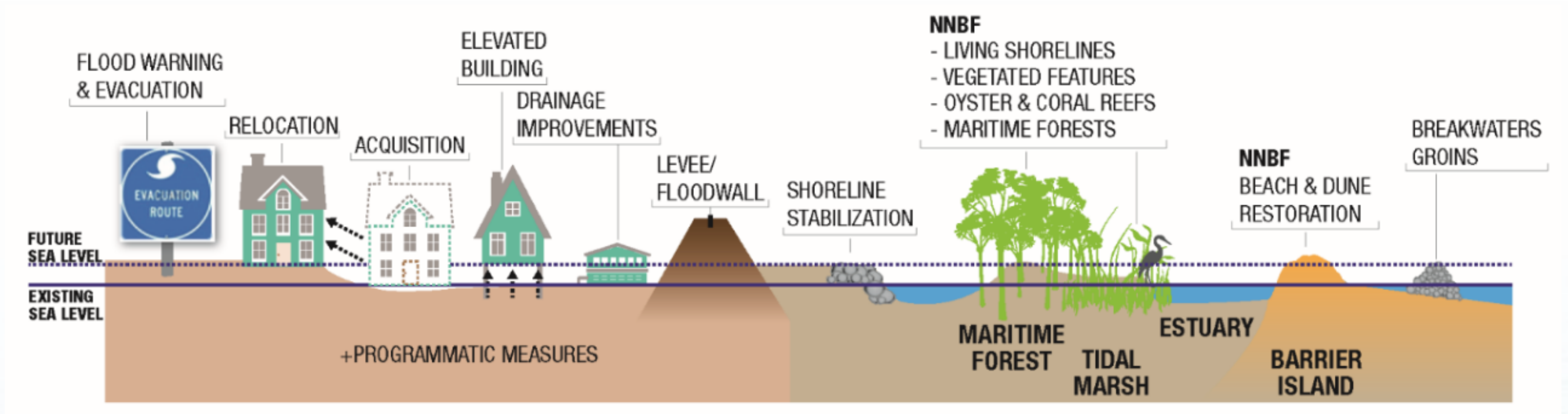
6-8 p.m. June 8, 2017

The Norfolk District and the City of Norfolk will present preliminary project measures and gather feedback from the public on those potential structural and nonstructural features.

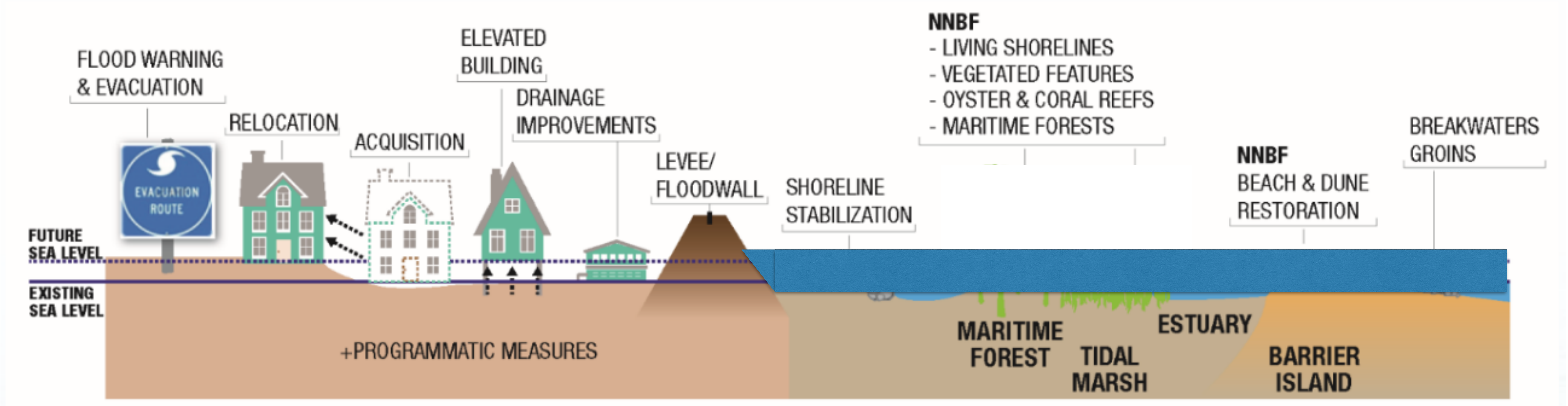
Norfolk District officials presented details of the Norfolk Coastal Storm Risk

Sea Level Rise

Sea Level Rise

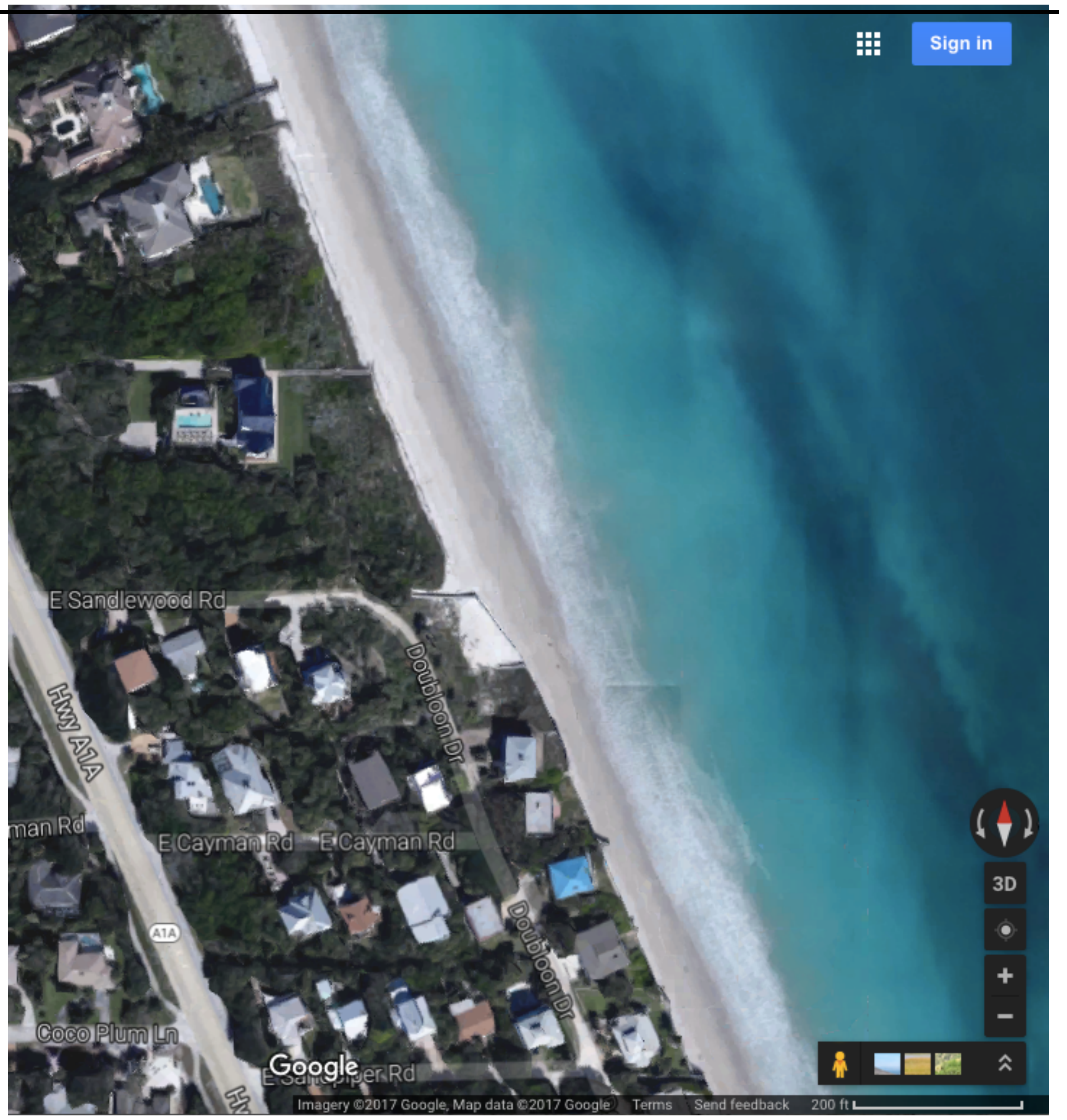


Sea Level Rise

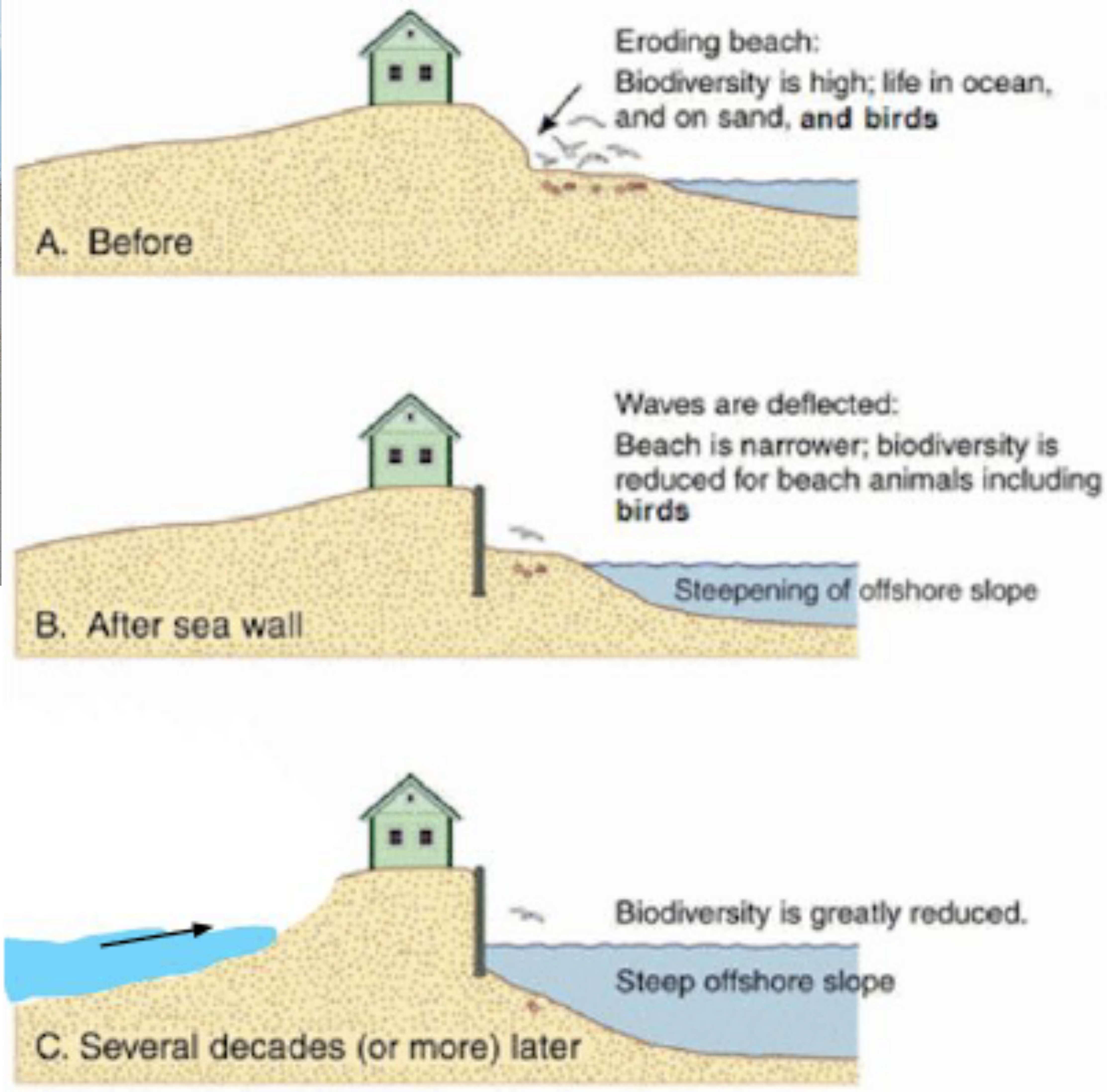


Sea Level Rise

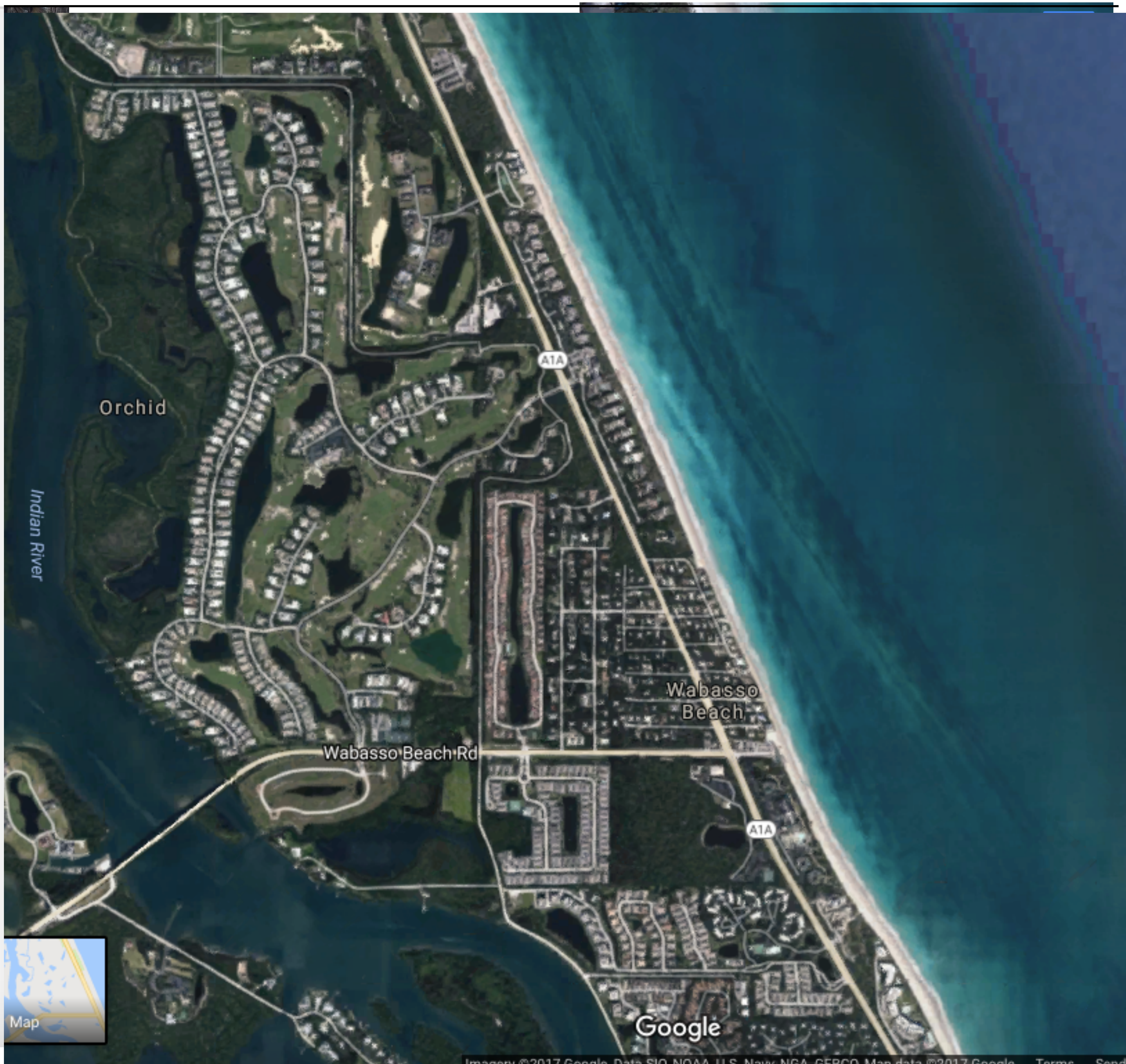
Sea Level Rise



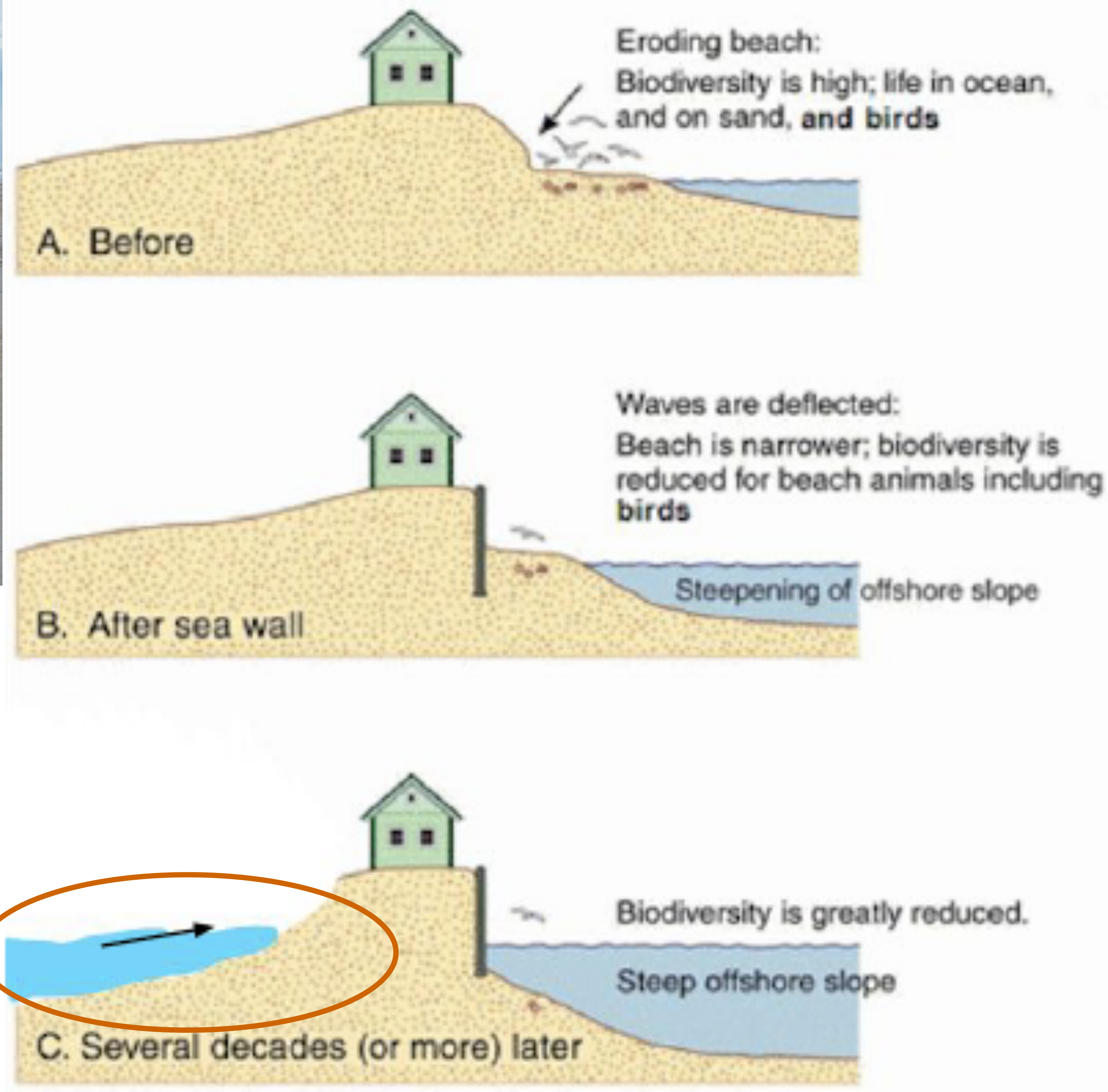
Sea Level Rise



Source: Pilkey, O.H. and Dixon, K. L. 1996 (modified) *The Corps and the Shore*. Island Press, Washington, D.C.

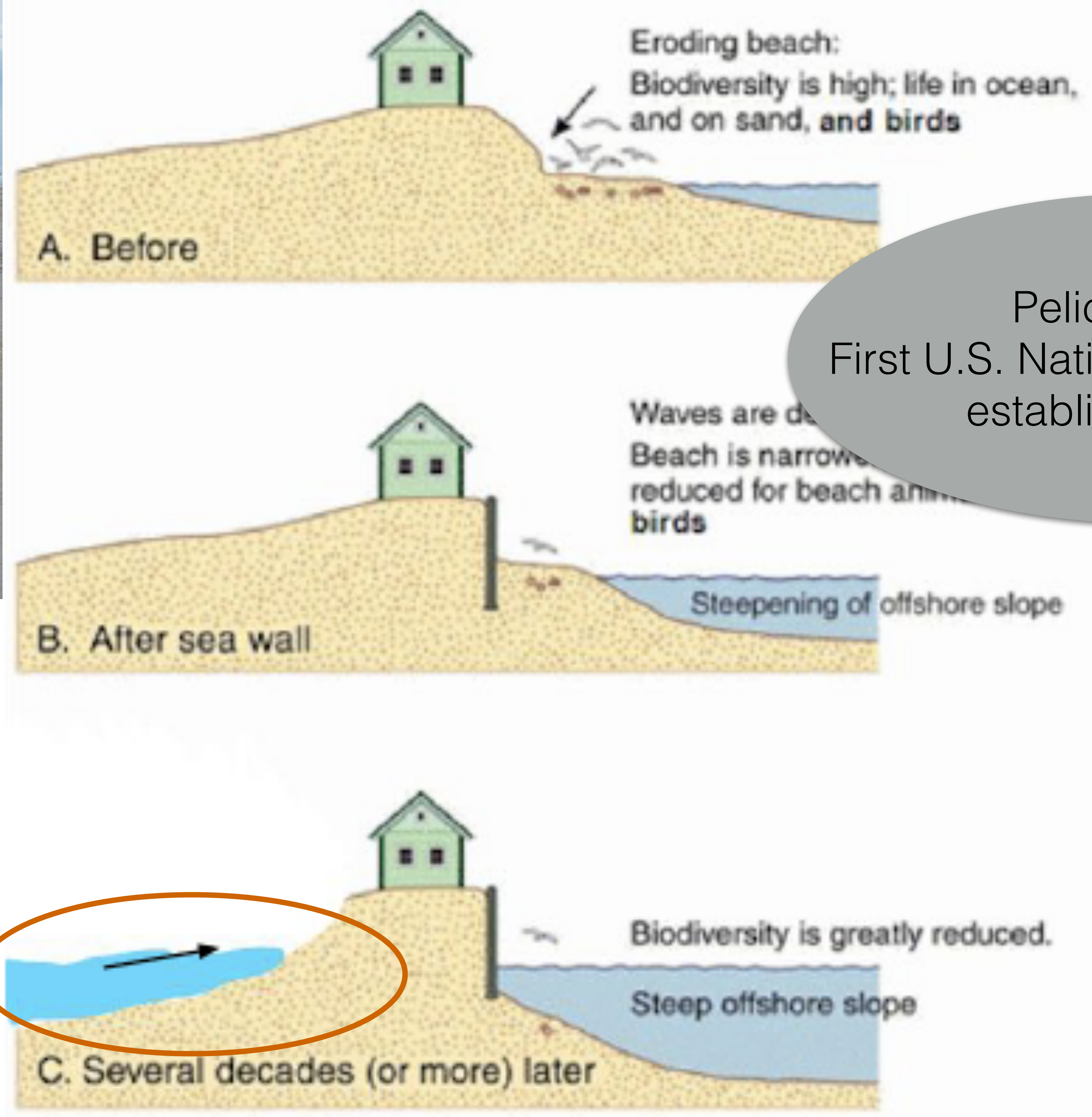


Sea Level Rise



Source: Pilkey, O.H. and Dixon, K. L. 1996
(modified) *The Corps and the Shore*. Island Press, Washington, D.C.

Sea Level Rise



Source: Pilkey, O.H. and Dixon, K. L. 1996 (modified) *The Corps and the Shore*. Island Press, Washington, D.C.

Pelican Island,
First U.S. National Wildlife Refuge
established in 1903

Natural Hazards and Disaster

Class 27: Climate Change Impacts

- Sea Level Rise
- Heat Waves
- Droughts
- Cold Spells
- Wildfires

Natural Hazards and Disaster

Class 27: Climate Change Impacts

- Sea Level Rise
- Heat Waves
- Droughts
- Cold Spells
- Wildfires

Heat Waves

A heat wave is a period of excessively high heat index.

Heat index is a measure of how hot it feels and it depends on temperature and humidity

The 1995 Chicago heat wave was heat wave, which led to 739 heat-related deaths in Chicago over a period of five days.

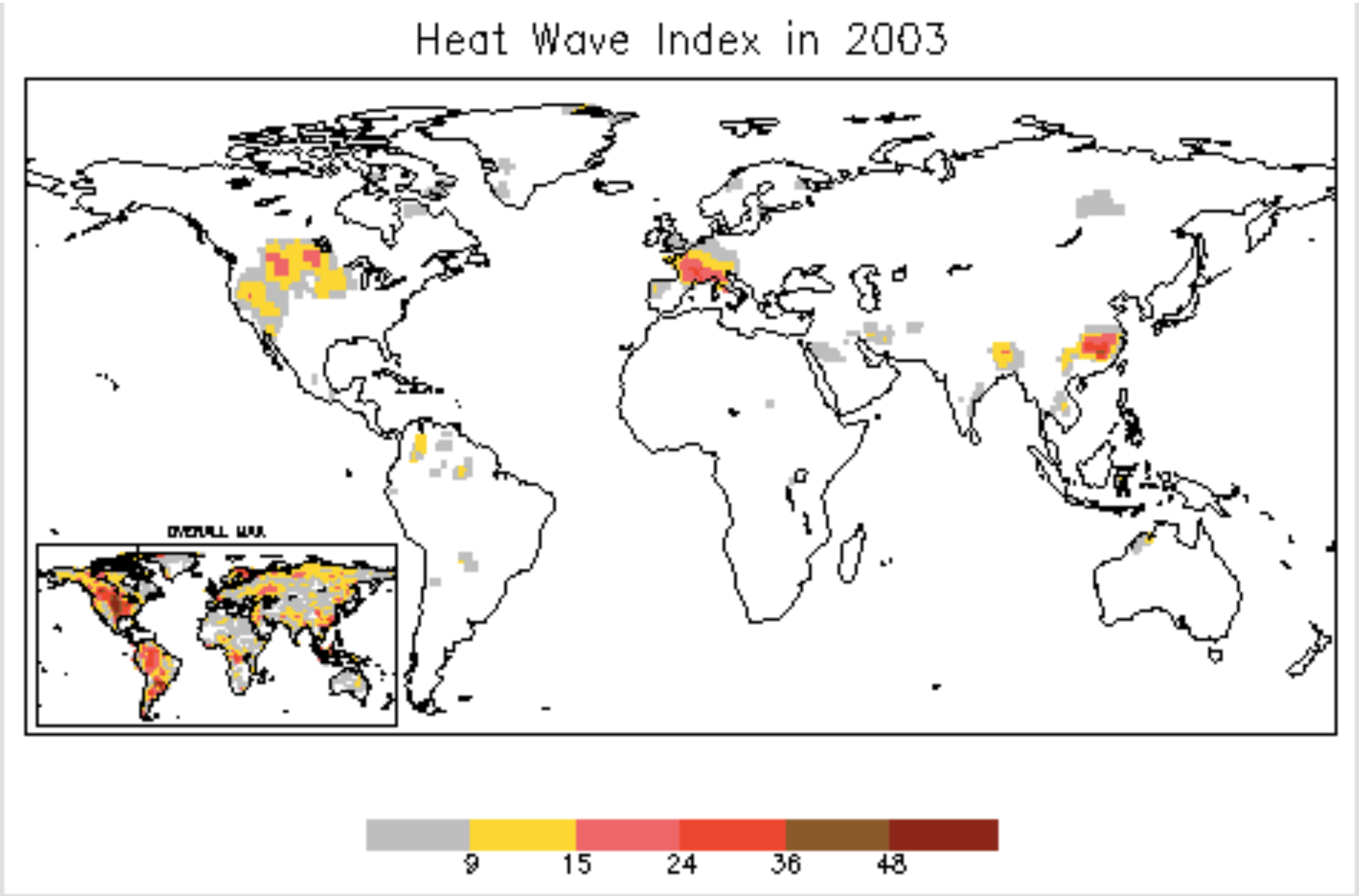
Klinenberg, 2002: Correlation between poverty, social capital and death

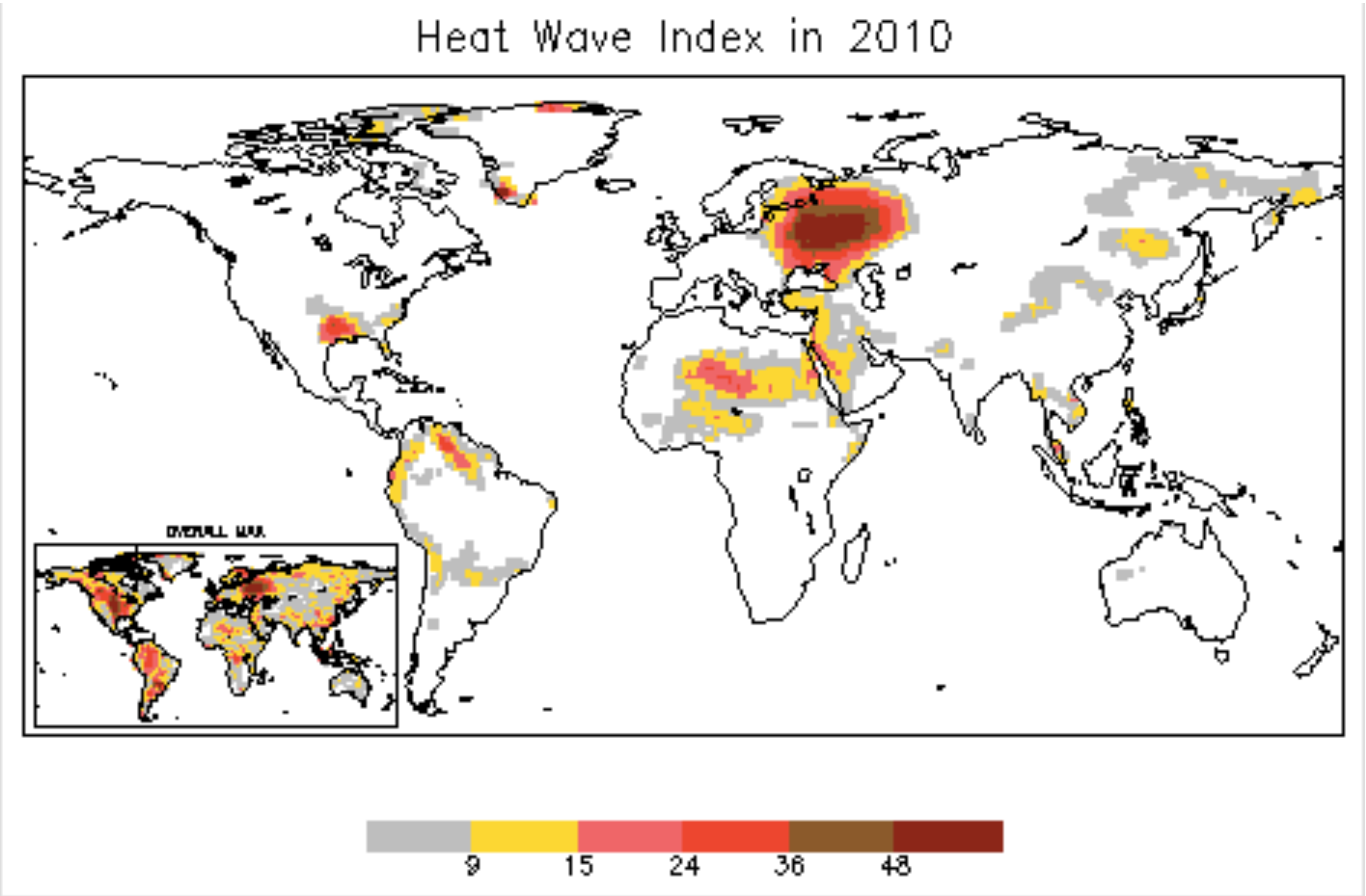
NOAA national weather service: heat index

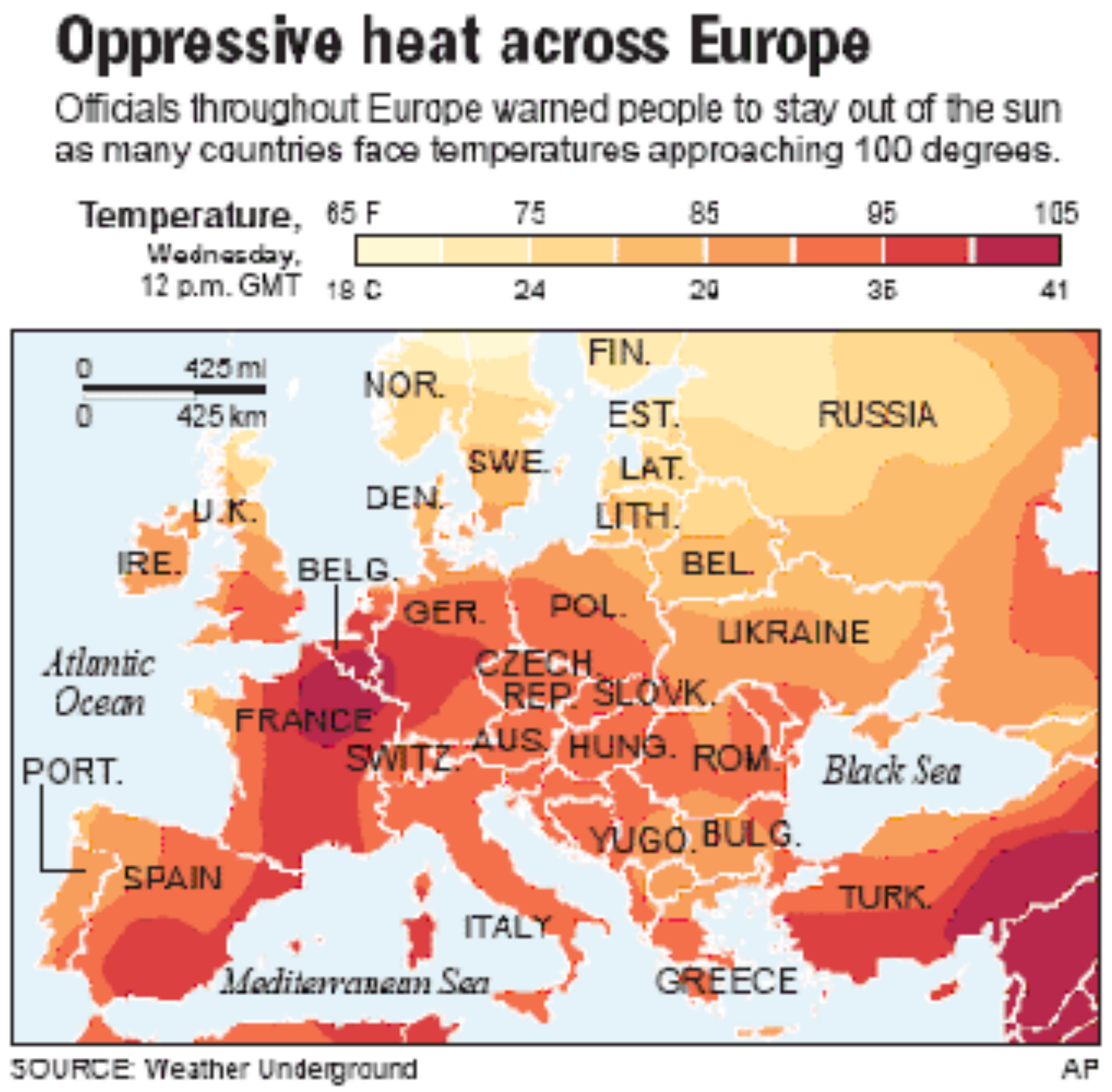
Relative humidity	Temperature															
	80 °F (27 °C)	82 °F (28 °C)	84 °F (29 °C)	86 °F (30 °C)	88 °F (31 °C)	90 °F (32 °C)	92 °F (33 °C)	94 °F (34 °C)	96 °F (36 °C)	98 °F (37 °C)	100 °F (38 °C)	102 °F (39 °C)	104 °F (40 °C)	106 °F (41 °C)	108 °F (42 °C)	110 °F (43 °C)
40%	80 °F (27 °C)	81 °F (27 °C)	83 °F (28 °C)	85 °F (29 °C)	88 °F (31 °C)	91 °F (33 °C)	94 °F (34 °C)	97 °F (36 °C)	101 °F (38 °C)	105 °F (41 °C)	109 °F (43 °C)	114 °F (46 °C)	119 °F (48 °C)	124 °F (51 °C)	130 °F (54 °C)	136 °F (58 °C)
45%	80 °F (27 °C)	82 °F (28 °C)	84 °F (29 °C)	87 °F (31 °C)	89 °F (32 °C)	93 °F (34 °C)	96 °F (36 °C)	100 °F (38 °C)	104 °F (40 °C)	109 °F (43 °C)	114 °F (46 °C)	119 °F (48 °C)	124 °F (51 °C)	130 °F (54 °C)	137 °F (58 °C)	
50%	81 °F (27 °C)	83 °F (28 °C)	85 °F (29 °C)	88 °F (31 °C)	91 °F (33 °C)	95 °F (35 °C)	99 °F (37 °C)	103 °F (39 °C)	108 °F (42 °C)	113 °F (45 °C)	118 °F (48 °C)	124 °F (51 °C)	131 °F (55 °C)	137 °F (58 °C)		
55%	81 °F (27 °C)	84 °F (29 °C)	86 °F (30 °C)	89 °F (32 °C)	93 °F (34 °C)	97 °F (36 °C)	101 °F (38 °C)	106 °F (41 °C)	112 °F (44 °C)	117 °F (47 °C)	124 °F (51 °C)	130 °F (54 °C)	137 °F (58 °C)			
60%	82 °F (28 °C)	84 °F (29 °C)	88 °F (31 °C)	91 °F (33 °C)	95 °F (35 °C)	100 °F (38 °C)	105 °F (41 °C)	110 °F (43 °C)	116 °F (47 °C)	123 °F (51 °C)	129 °F (54 °C)	137 °F (58 °C)				
65%	82 °F (28 °C)	85 °F (29 °C)	89 °F (32 °C)	93 °F (34 °C)	98 °F (37 °C)	103 °F (39 °C)	108 °F (42 °C)	114 °F (46 °C)	121 °F (49 °C)	128 °F (53 °C)	136 °F (58 °C)					
70%	83 °F (28 °C)	86 °F (30 °C)	90 °F (32 °C)	95 °F (35 °C)	100 °F (38 °C)	105 °F (41 °C)	112 °F (44 °C)	119 °F (48 °C)	126 °F (52 °C)	134 °F (57 °C)						
75%	84 °F (29 °C)	88 °F (31 °C)	92 °F (33 °C)	97 °F (36 °C)	103 °F (39 °C)	109 °F (43 °C)	116 °F (47 °C)	124 °F (51 °C)	132 °F (56 °C)							
80%	84 °F (29 °C)	89 °F (32 °C)	94 °F (34 °C)	100 °F (38 °C)	106 °F (41 °C)	113 °F (45 °C)	121 °F (49 °C)	129 °F (54 °C)								
85%	85 °F (29 °C)	90 °F (32 °C)	96 °F (36 °C)	102 °F (39 °C)	110 °F (43 °C)	117 °F (47 °C)	126 °F (52 °C)	135 °F (57 °C)								
90%	86 °F (30 °C)	91 °F (33 °C)	98 °F (37 °C)	105 °F (41 °C)	113 °F (45 °C)	122 °F (50 °C)	131 °F (55 °C)									
95%	86 °F (30 °C)	93 °F (34 °C)	100 °F (38 °C)	108 °F (42 °C)	117 °F (47 °C)	127 °F (53 °C)										
100%	87 °F (31 °C)	95 °F (35 °C)	103 °F (39 °C)	112 °F (44 °C)	121 °F (49 °C)	132 °F (56 °C)										

Key to colors: Caution, Extreme caution, Danger, Extreme danger

Heat Waves



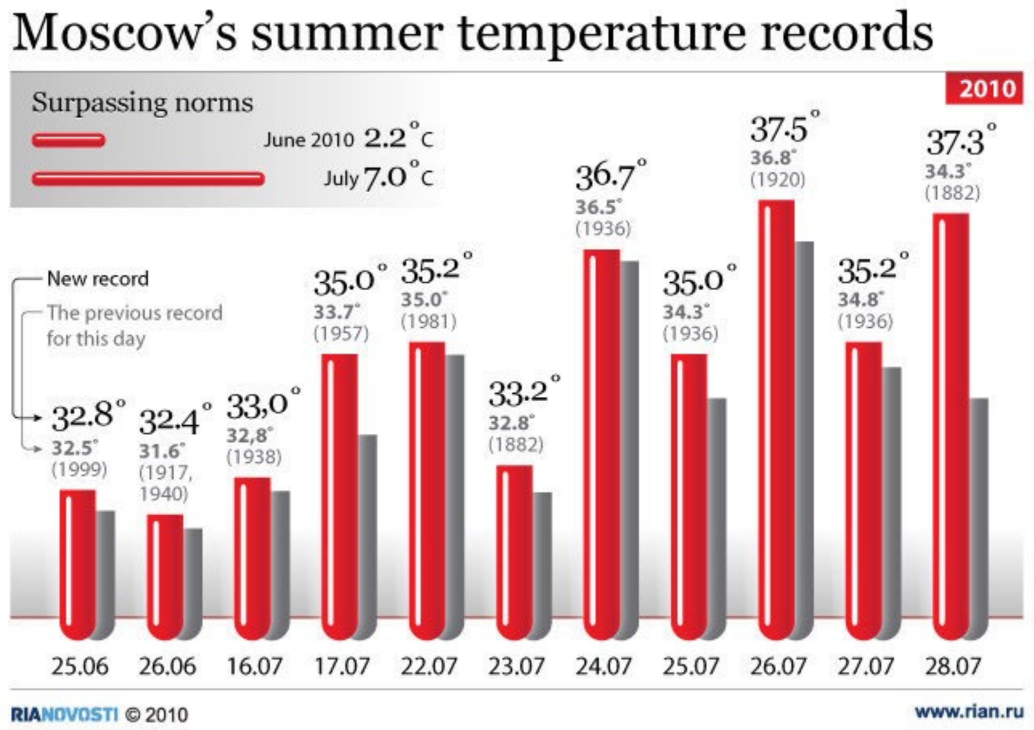




Hottest summer in Europe since 1540;

Combined with a sever drought;

Death toll: estimated 70,000



Death toll in Russia from heat and wild fires: estimated 56,000 (Munich Re)

The Hot Summer of 2010: Redrawing the Temperature Record Map of Europe

David Barriopedro[1,*], Erich M. Fischer[2], Jürg Luterbacher[3], Ricardo M. Trigo[1], and Ricardo García-Herrera[4]

+ See all authors and affiliations

Science 17 Mar 2011:
1201224
DOI: 10.1126/science.1201224

Article Figures & Data Info & Metrics eLetters PDF

The summer of 2010 was exceptionally warm in eastern Europe and large parts of Russia. We provide evidence that the anomalous 2010 warmth that caused adverse impacts exceeded the amplitude and spatial extent of the previous hottest summer of 2003. "Mega-heatwaves" such as the 2003 and 2010 events broke the 500-year-long seasonal temperature records over approximately 50% of Europe. According to regional multi-model experiments, the probability of a summer experiencing "mega-heatwaves" will increase by a factor of 5 to 10 within the next 40 years. However, the magnitude of the 2010 event was so extreme that despite this increase, the occurrence of an analogue over the same region remains fairly unlikely until the second half of the 21st century.

Ten deadliest heat waves

Rank	Death toll	Event	Location	Date
1.	70,000	2003 European heat wave	Europe	2003
2.	56,000	2010 Russian heat wave	Russia	2010
3.	9,500	1901 eastern United States heat wave	United States	1901
4.	5,000–10,000	1988 United States heat wave	United States	1988
5.	3,418	2006 European heat wave	Europe	2006[56]
6.	2,541	1998 India heat wave	India	1998[56]
7.	2,500	2015 Indian heat wave	India	2015
		2015 Pakistan heat wave	Pakistan	2015
9.	1,700–5,000	1980 United States heat wave	United States	1980
10.	1,718	2010 Japanese heat wave	Japan	2010[57]

Natural Hazards and Disaster

Class 25: Climate Change Impacts

- Sea Level Rise
- Heat Waves
- Droughts
- Cold Spells
- Wildfires

Natural Hazards and Disaster

Class 25: Climate Change Impacts

- Sea Level Rise
- Heat Waves
- Droughts
- Cold Spells
- Wildfires

Droughts

A drought is an extended period of below-normal precipitation in a region, leading to shortage of water supply.

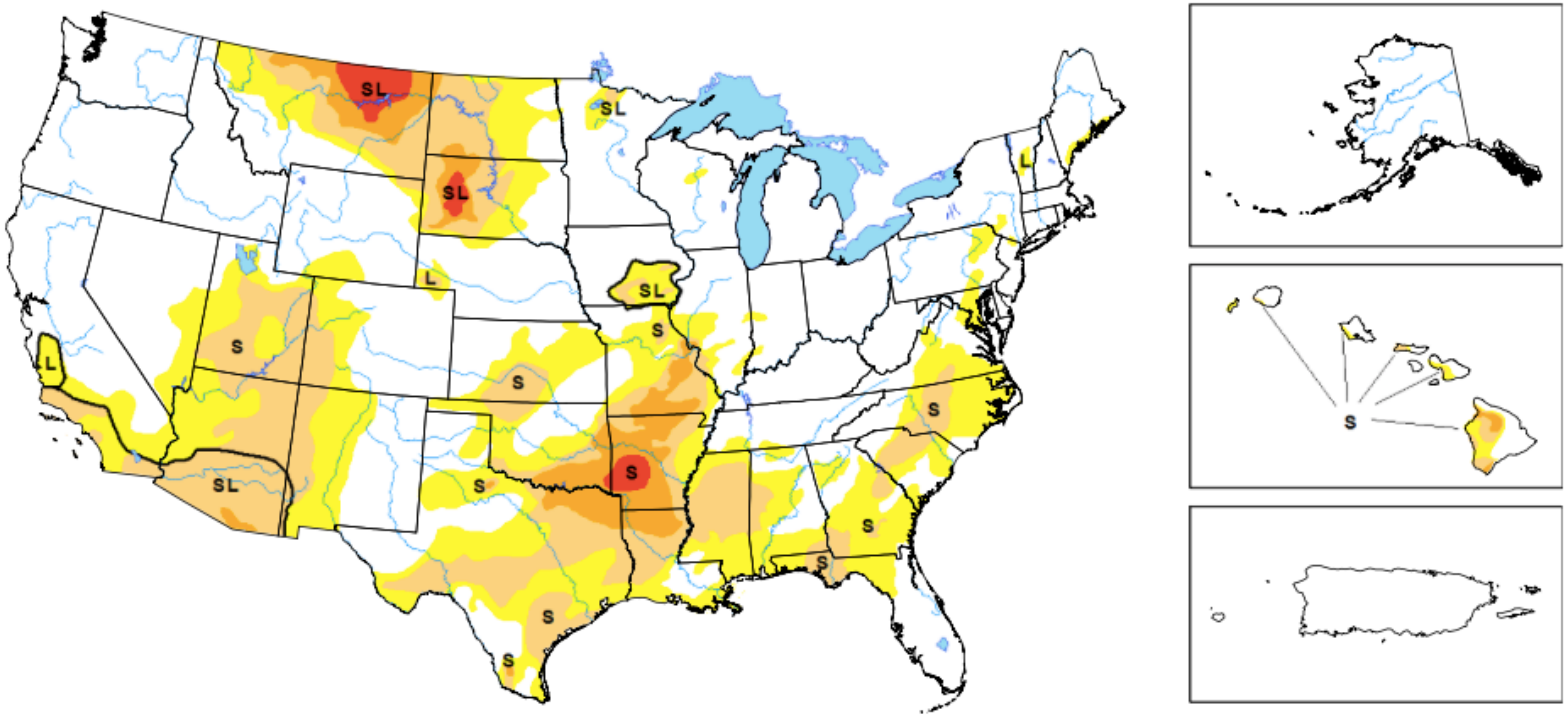
United States Drought Monitor

Login

Current Map | Maps | Data | Drought Summary | About USDM | Current Conditions and Outlooks | Update Bookmarks | En Español

Map for November 30, 2017

Data valid: November 28, 2017 | Author: David Simeral, Western Regional Climate Center



The data cutoff for Drought Monitor maps is each Tuesday at 7 a.m. EST. The maps, which are based on analysis of the data, are released each Thursday at 8:30 a.m. Eastern Time.

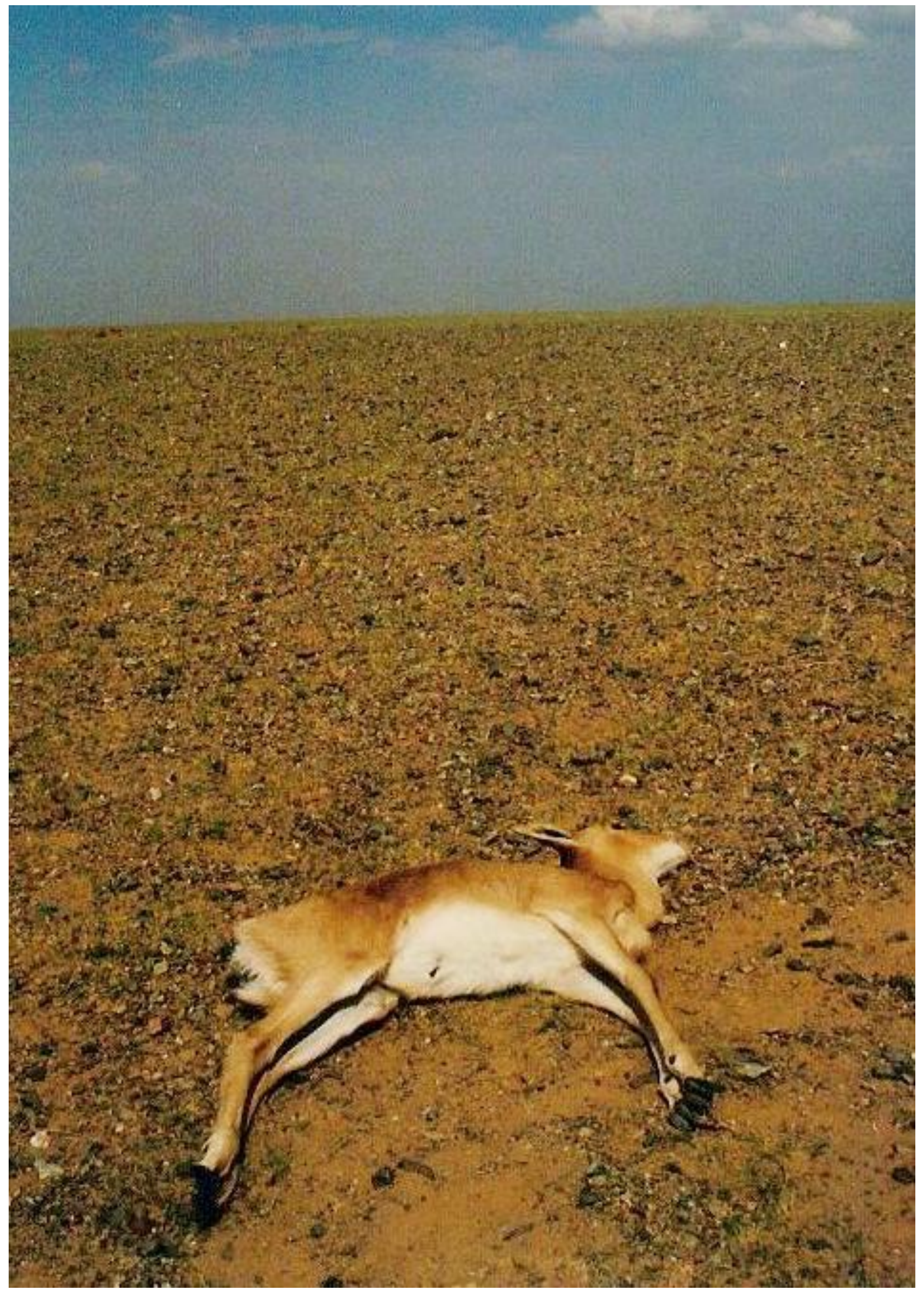
Intensity and Impacts

- None
- **D0** (Abnormally Dry)
- **D1** (Moderate Drought)
- **D2** (Severe Drought)
- **D3** (Extreme Drought)
- **D4** (Exceptional Drought)
- - Delineates dominant impacts
- **S** - Short-Term impacts, typically less than 6 months (e.g. agriculture, grasslands)
- **L** - Long-Term impacts, typically greater than 6 months (e.g. hydrology, ecology)

Droughts

A drought is an extended period of below-normal precipitation in a region, leading to shortage of water supply.

Droughts can have severe impacts on ecosystems.



Droughts

A drought is an extended period of below-normal precipitation in a region, leading to shortage of water supply.

Droughts can have severe impacts on ecosystems.

Droughts can cause economic problems, …

Droughts

A drought is an extended period of below-normal precipitation in a region, leading to shortage of water supply.

Droughts can have severe impacts on ecosystems.

Droughts can cause economic problems, famine, …

Madagascar

Reuters

Thursday 20 October 2016 20.44 EDT

This article is 1 year old

656

Madagascar drought: catastrophe looms as 850,000 go hungry, says UN

Drought in the south leaves households experiencing emergency levels of hunger, with nothing but wild fruits to eat

Farmers are in need of drought-tolerant seeds to prepare for the next planting season. Photograph: Timothy Jacobsen/AP

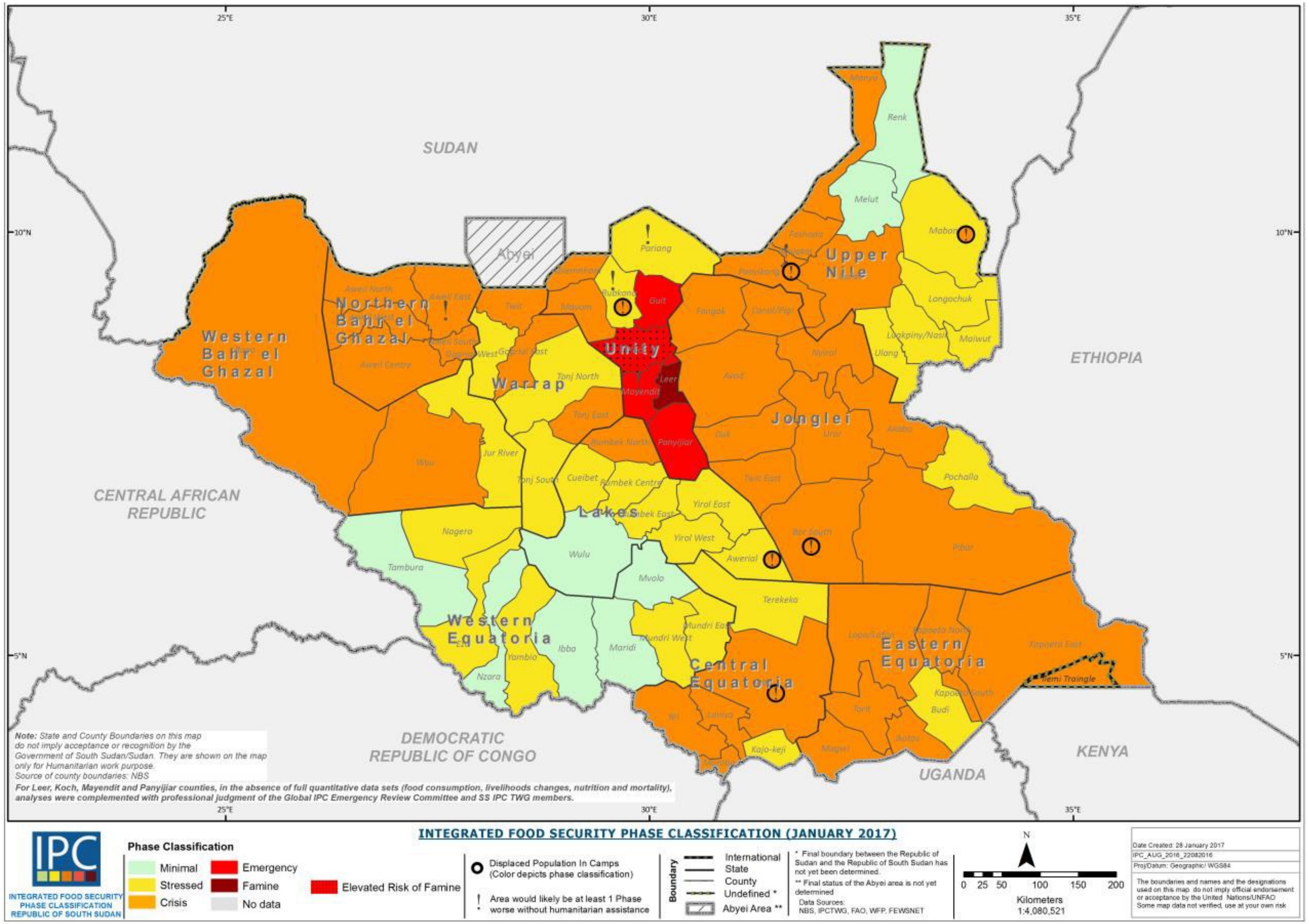
Nearly 850,000 people in drought-hit southern Madagascar are experiencing "alarming" levels of hunger, and more aid is needed to prevent a dire situation from becoming a "catastrophe", UN agencies said on Thursday.

Droughts

A drought is an extended period of below-normal precipitation in a region, leading to shortage of water supply.

Droughts can have severe impacts on ecosystems.

Droughts can cause economic problems, famine, …



Droughts

A drought is an extended period of below-normal precipitation in a region, leading to shortage of water supply.

Droughts can have severe impacts on ecosystems.

Droughts can cause economic problems, famine, and social unrest

Researchers Link Syrian Conflict to a Drought Made Worse by Climate Change

By HENRY FOUNTAIN MARCH 2, 2015

Women working in fields in northeastern Syria in 2010. A new report suggests extreme drought in Syria was most likely a factor in the violent uprising that began there in 2011.

Louai Beshara/Agence France-Presse — Getty Images

RELATED COVERAGE

ISIS Onslaught Engulfs Assyrian Christians as Militants Destroy Ancient Art FEB. 26, 2015

Surviving an ISIS Massacre SEPT. 3, 2014

The Evolution of ISIS DEC. 13, 2014

Droughts

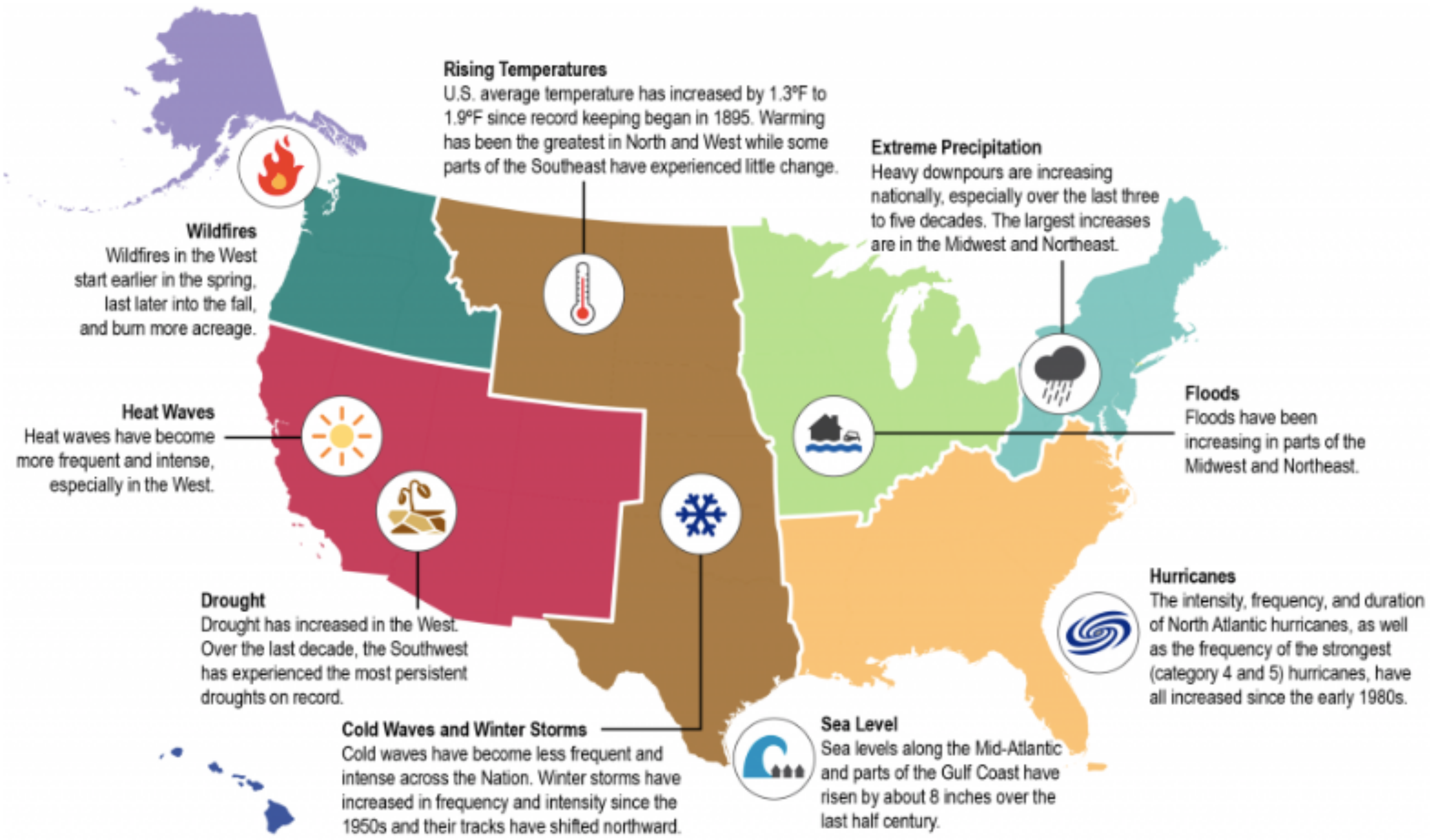
A drought is an extended period of below-normal precipitation in a region, leading to shortage of water supply.

Droughts can have severe impacts on ecosystems.

Droughts can cause economic problems, famine, and social unrest

Climate change may increase droughts significantly

Figure 1.1: Major U.S. Climate Trends



Major U.S. national and regional climate trends. Shaded areas are the U.S. regions defined in the 2014 NCA.[3, 4]

https://health2016.globalchange.gov/climate-change-and-human-health

Droughts

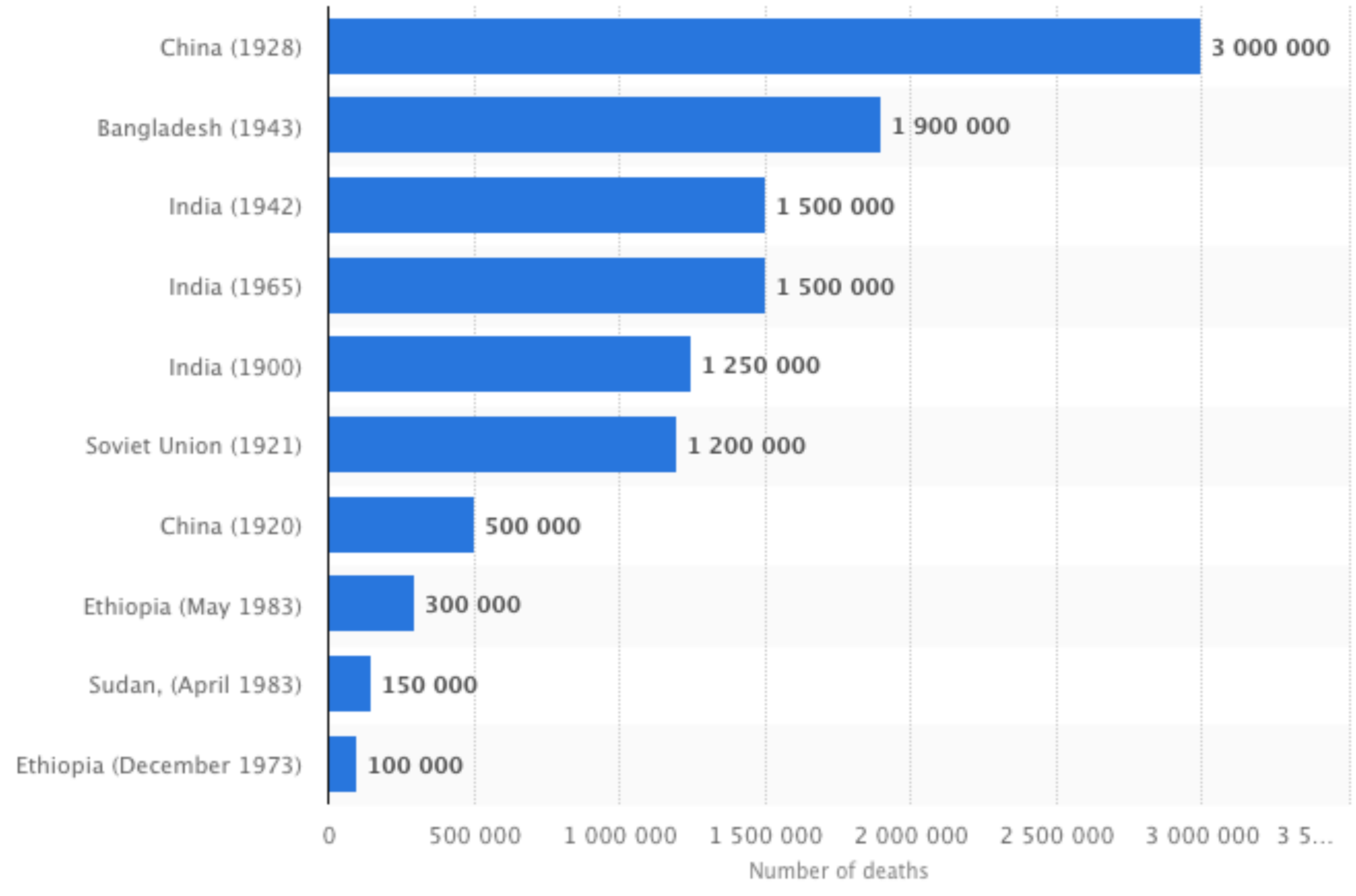
statista The Statistics Portal
Statistics and Studies from more than 18,000 Sources

Enter search term, e.g. social media

Prices & Access | Statistics | Reports | Consumer Markets | Digital Markets | Infographics | Our Services | Login

Society › Geography & Environment › Number of deaths caused by majors droughts worldwide up to 2016

Number of deaths caused by majors droughts worldwide from 1900 to 2016*



Data visualized by +ableau

© Statista 2017

DOWNLOAD SETTINGS SHARE

PNG + PDF + XLS + PPT +

DESCRIPTION SOURCE MORE INFORMATION

This statistic illustrates deaths due to drought worldwide from 1900 to 2016*. The dry period of April 1983 in Sudan caused around 150,000 deaths.

Deaths due to drought worldwide

The 1928 drought in the People's Republic of China was the deadliest drought during the period between 1900 and 2016, causing the death of an estimated three million people. This drought in the Chinese provinces of Henan, Shaanxi and Gansu brought about crop failure and widespread famine. It lasted from 1928 to 1930 and the effects were exacerbated by insufficient or inefficient government relief and

Droughts

Major famines

Many of the large famines are caused by a combination of environmental conditions and mismanagement

Note: Some of these famines may be caused or partially caused by humans.

Rank	Death toll	Event	Location	Date
1.	15,000,000–43,000,000	Great Chinese Famine	China	1958–1961
2.	25,000,000[citation needed]	Chinese Famine of 1907	China	1907
3.	13,000,000[46]	Northern Chinese Famine of 1876–1879	China	1876–1879
4.	11,000,000	Doji bara famine or Skull famine	India	1789–1792
5.	10,000,000	Bengal famine of 1770, incl. Bihar & Orissa	India	1769–1771
6.	6,000,000+	Indian Famine	British India	1896–1902
7.	7,500,000	Great European Famine	Europe (all)	1315–1317
8.	7,000,000–10,000,000	Soviet famine of 1932–1933 (Holodomor in Ukraine)	Soviet Union	1932–1934
9.	5,250,000	Indian Great Famine of 1876–78	India	1876–1878
10.	5,000,000	Chinese Famine of 1936	China	1936
		Russian famine of 1921	Russia, Ukraine	1921–1922
12.	3,000,000	Chinese famine of 1928–1930	China	1928–1930
13.	2,000,000–3,000,000	Chinese Drought 1941	China	1942–1943
14.	2,000,000	Russian famine of 1601–1603	Russia (Muscovy)	1601–1603
		Deccan Famine of 1630–32	India	1630–1632
		Upper Doab famine of 1860–61	India	1860–1861
		French Famine	France	1693–1694
		Great Persian Famine of 1870–71	Persia	1870–1871
19.	1,500,000–7,000,000	Bengal Famine of 1943	India	1943
20.	1,500,000	Great Irish Famine	Ireland	1846–1849

Natural Hazards and Disaster

Class 27: Climate Change Impacts

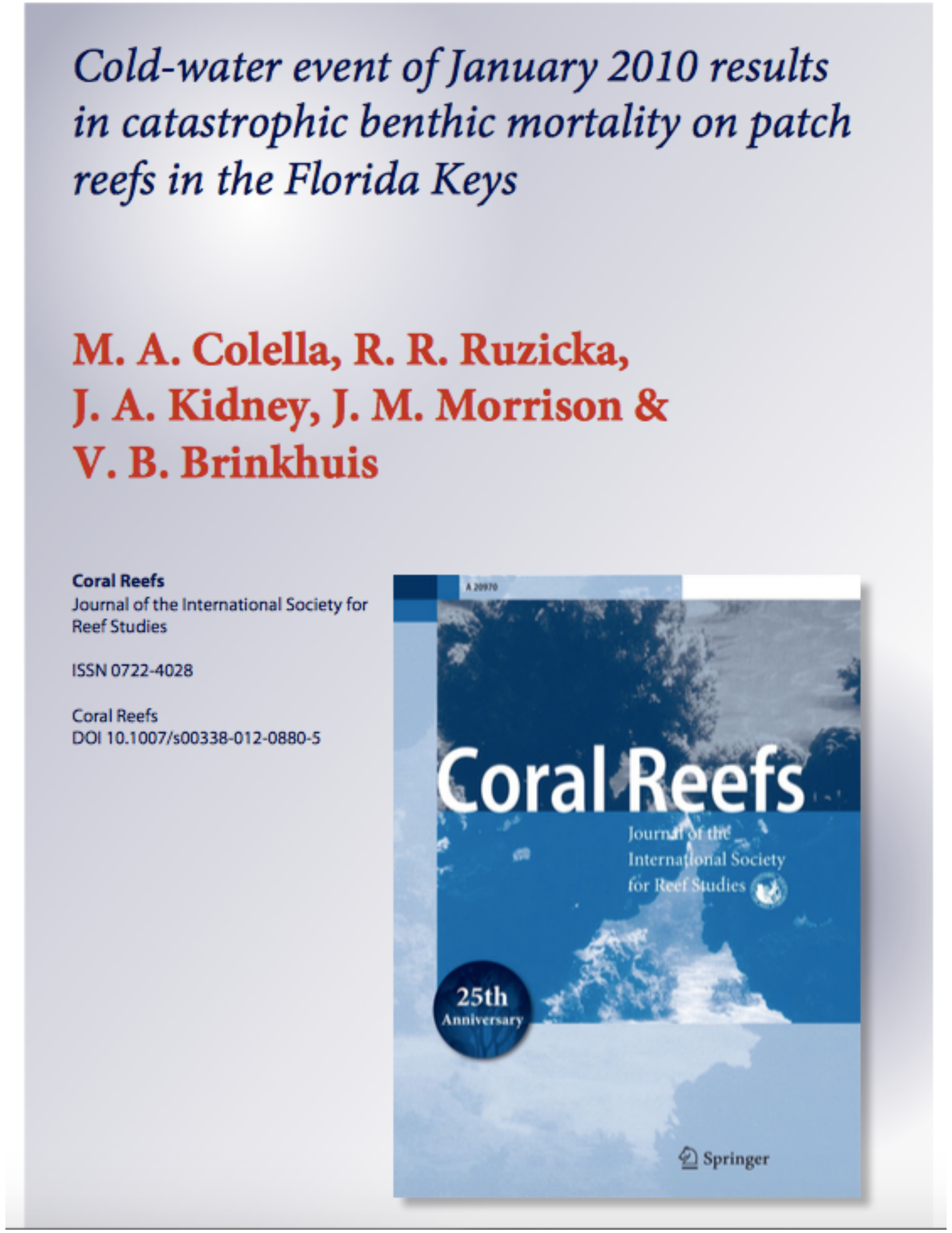
- Sea Level Rise
- Heat Waves
- Droughts
- Cold Spells
- Wildfires

Natural Hazards and Disaster

Class 27: Climate Change Impacts

- Sea Level Rise
- Heat Waves
- Droughts
- Cold Spells
- Wildfires

Cold Spells



Cold-water event of January 2010 results in catastrophic benthic mortality on patch reefs in the Florida Keys

M. A. Colella, R. R. Ruzicka, J. A. Kidney, J. M. Morrison & V. B. Brinkhuis

Coral Reefs
Journal of the International Society for Reef Studies

ISSN 0722-4028

Coral Reefs
DOI 10.1007/s00338-012-0880-5

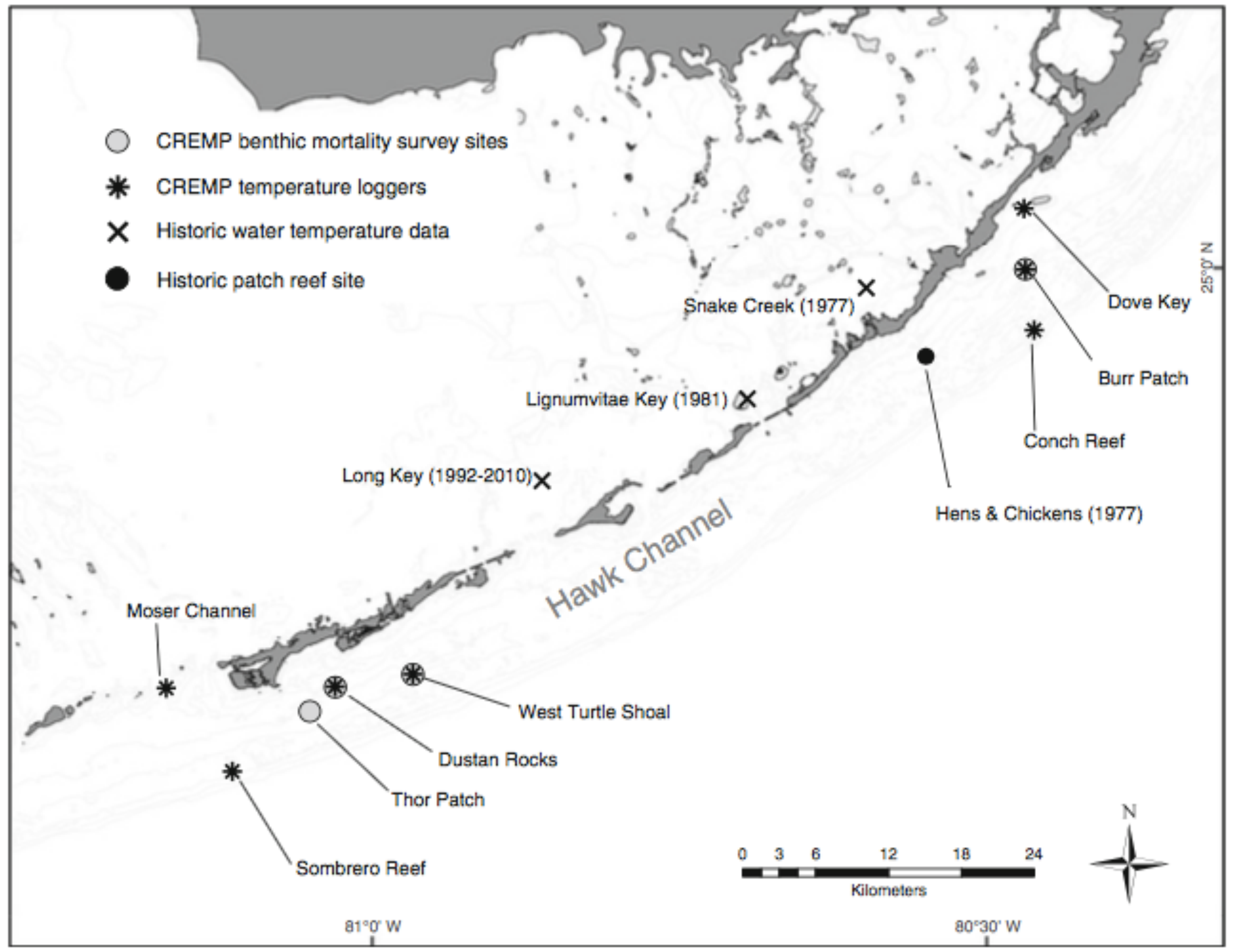


Fig. 1 Map of the *middle* and *upper* Florida Keys showing the location of coral reef evaluation and monitoring project (*CREMP*) survey sites, sites with temperature logger data, and historical sites where temperature data were collected

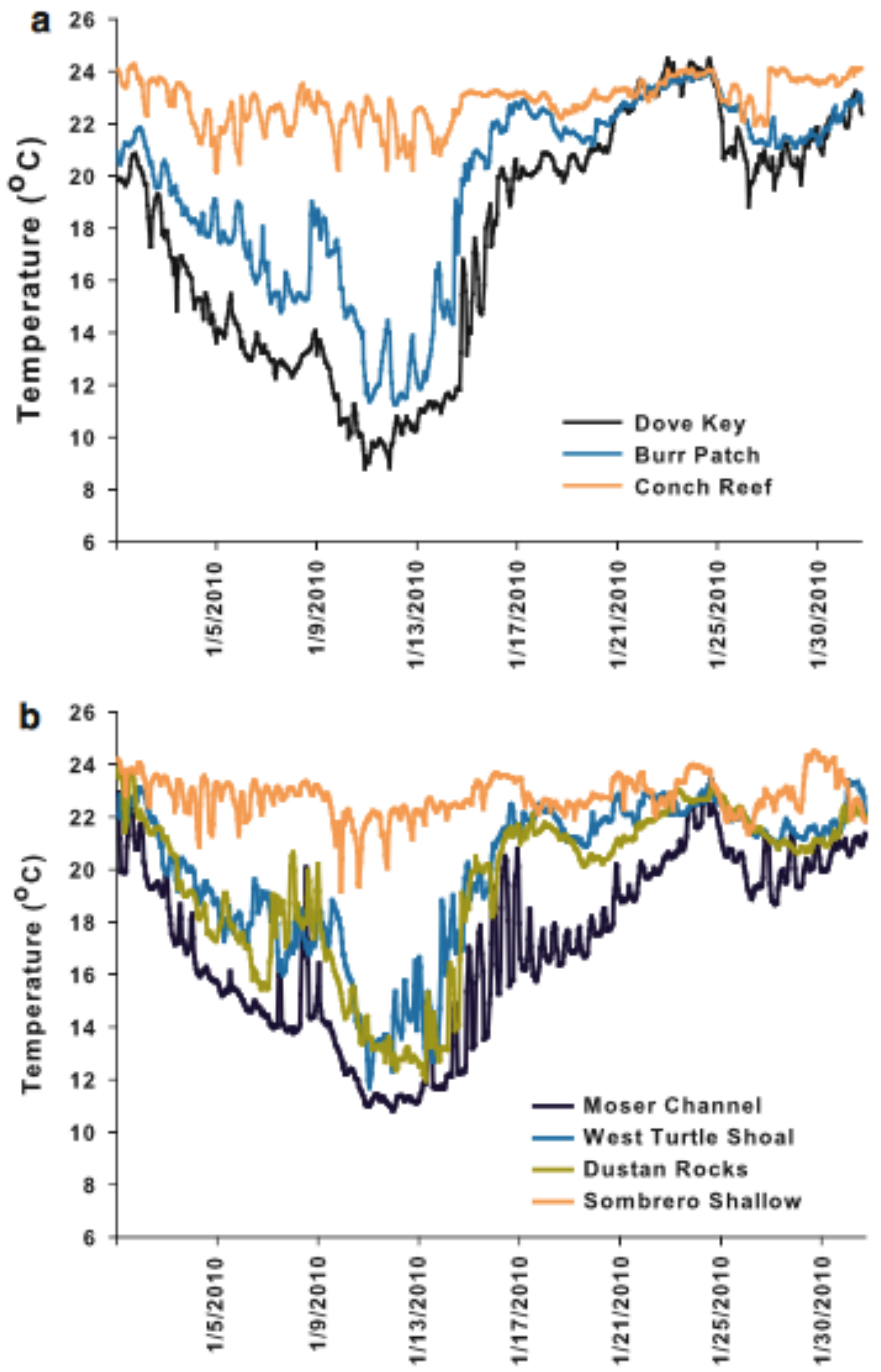


Fig. 2 Hourly in situ water temperature recordings from 1 to 30 January 2010. **a** Upper Keys sites: Dove Key, Burr Patch, and Conch Reef. **b** Middle Keys sites: Moser Channel, West Turtle Shoal, Dustan Rocks, and Sombrero Reef. Corresponding locations are shown in Fig. 1

Wildfires

Most deadliest wild fires

Rank	Death toll	Event	Location	Date
1.	1,200–2,500	Peshtigo Fire, Wisconsin	United States	October 8, 1871
2.	1,200	Kursha-2 Fire	Soviet Union	August 3, 1936
3.	453	Cloquet Fire, Minnesota	United States	October 12, 1918
4.	418	Great Hinckley Fire, Minnesota	United States	September 1, 1894
5.	282	Thumb Fire, Michigan	United States	September 5, 1881
6.	273	Matheson Fire, Ontario	Canada	July 29, 1916
7.	213	Black Dragon Fire	China	May 1, 1987
8.	173	Black Saturday bushfires	Australia	February 7, 2009
9.	160	Miramichi Fire	Canada	October 1825
10.	87	Great Fire of 1910	United States	August 20, 1910
11.	84	2007 Greek forest fires	Greece	June 28, 2007
12.	82	1949 Landes Forest Fire	France	August 19, 1949
13.	75	Ash Wednesday bushfires	Australia	February 16, 1983
14.	73	Great Porcupine Fire	Canada	July 11, 1911
15.	71	Black Friday bushfires	Australia	January 13, 1939
16.	64	2017 Portugal wildfires	Portugal	June 17, 2017
17.	62	1967 Tasmanian fires	Australia	February 7, 1967
18.	60	1926 Victorian bushfires	Australia	January 26, 1926
19.	54	2010 Russian wildfires	Russia	July 29, 2010
20.	49	October 2017 Iberian wildfires	Portugal and Spain	October 15, 2017

Wildfires

Statistics

U.S. Wildfires

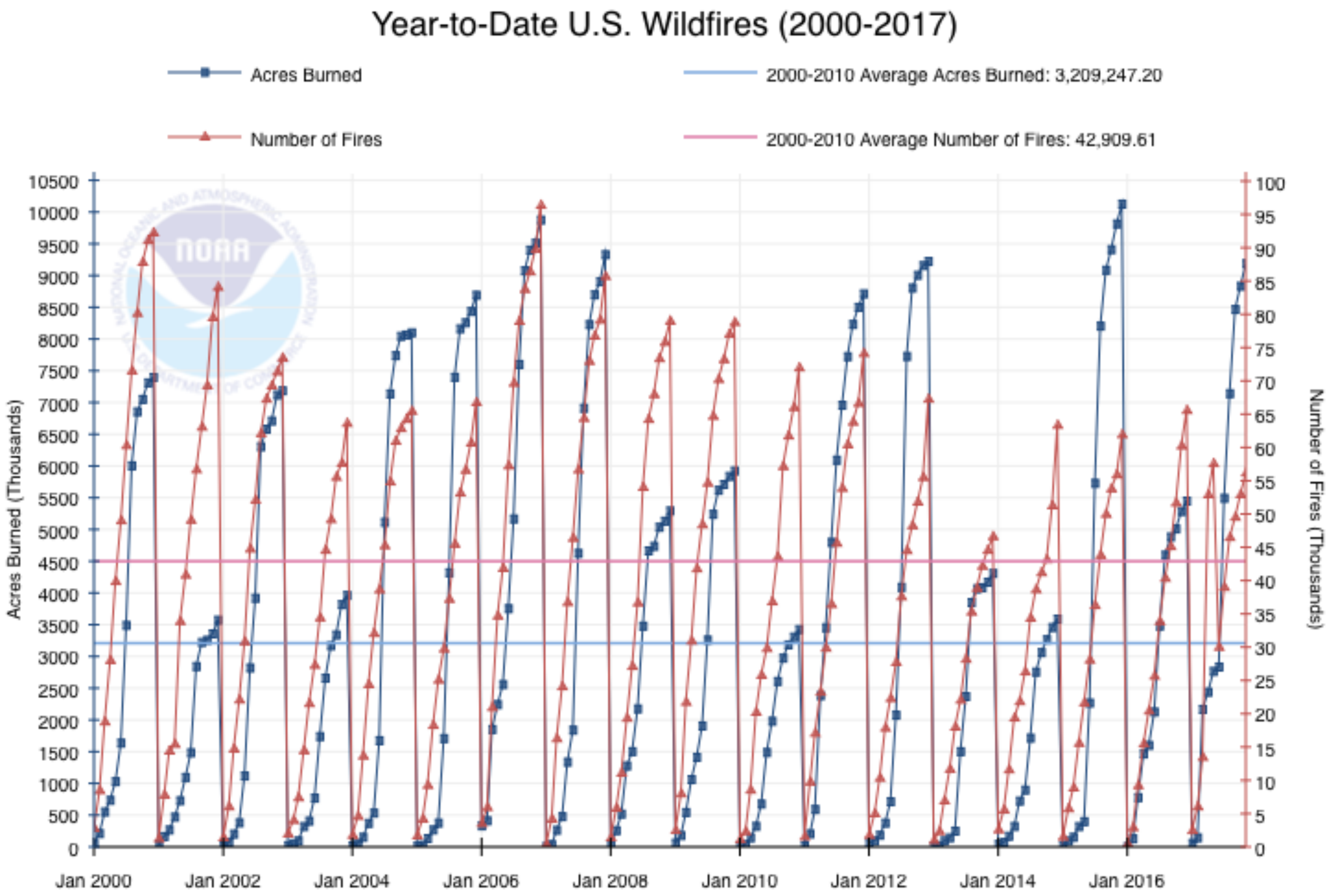
- Climate Monitoring
- State of the Climate
- Temp, Precip, and Drought
- Climate at a Glance
- Extremes
- Societal Impacts
- Snow and Ice
- Teleconnections
- GHCN Monthly
- Monitoring References

U.S. Wildfire statistics provided by the National Interagency Fire Center (NIFC) are available from 2000–2017 for the Contiguous U.S. Anomalies are relative to the 2000–2010 average.

Parameter: Acres Burned ☑ Number of Fires ☑ Acres Burned per Fire ☐

Timescale: Year-to-Date **Month:** All Months Plot

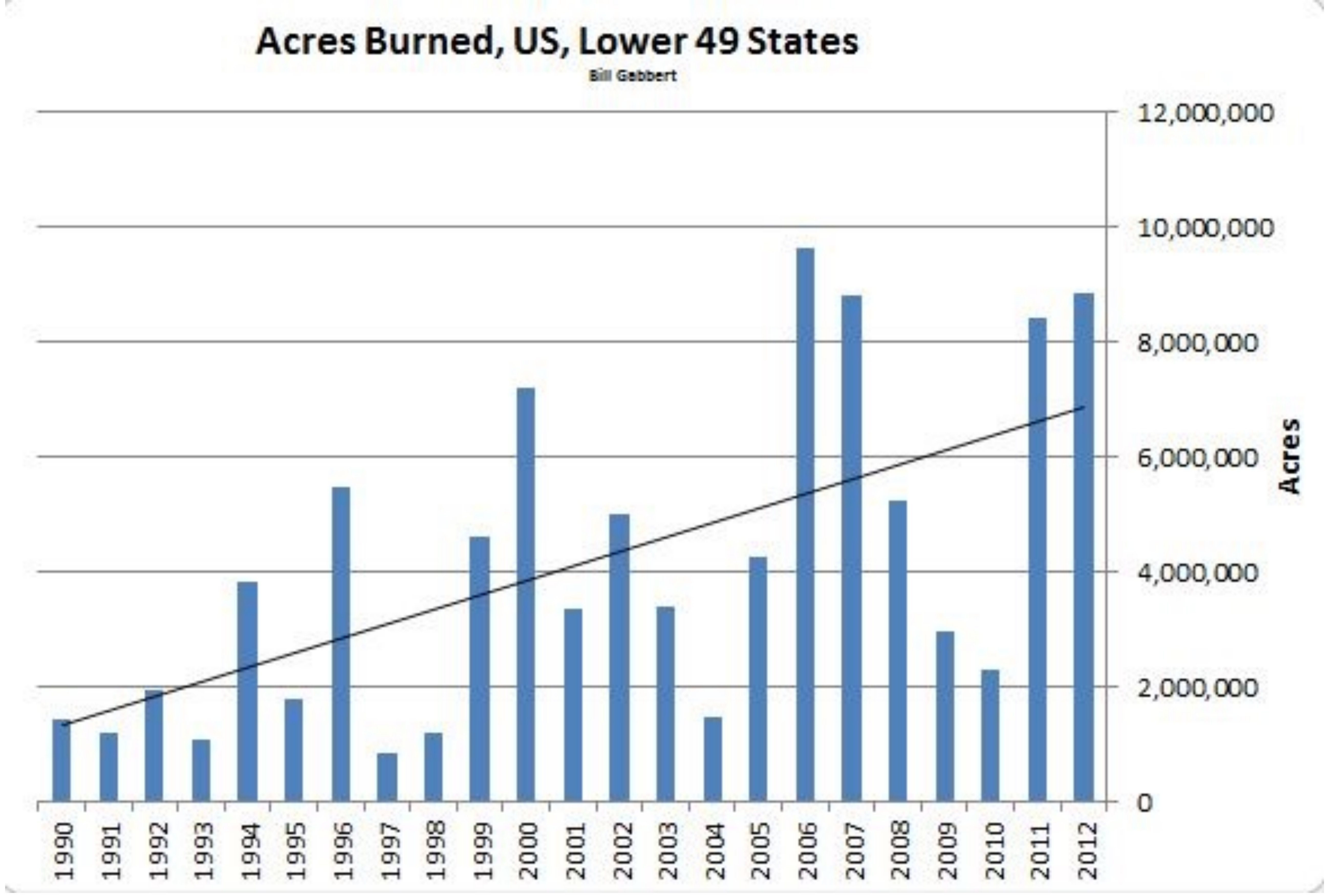
*Place mouse on axis and left-click to **pan**; wheel up/down for **zoom** in/out (or shift key+left-click).*

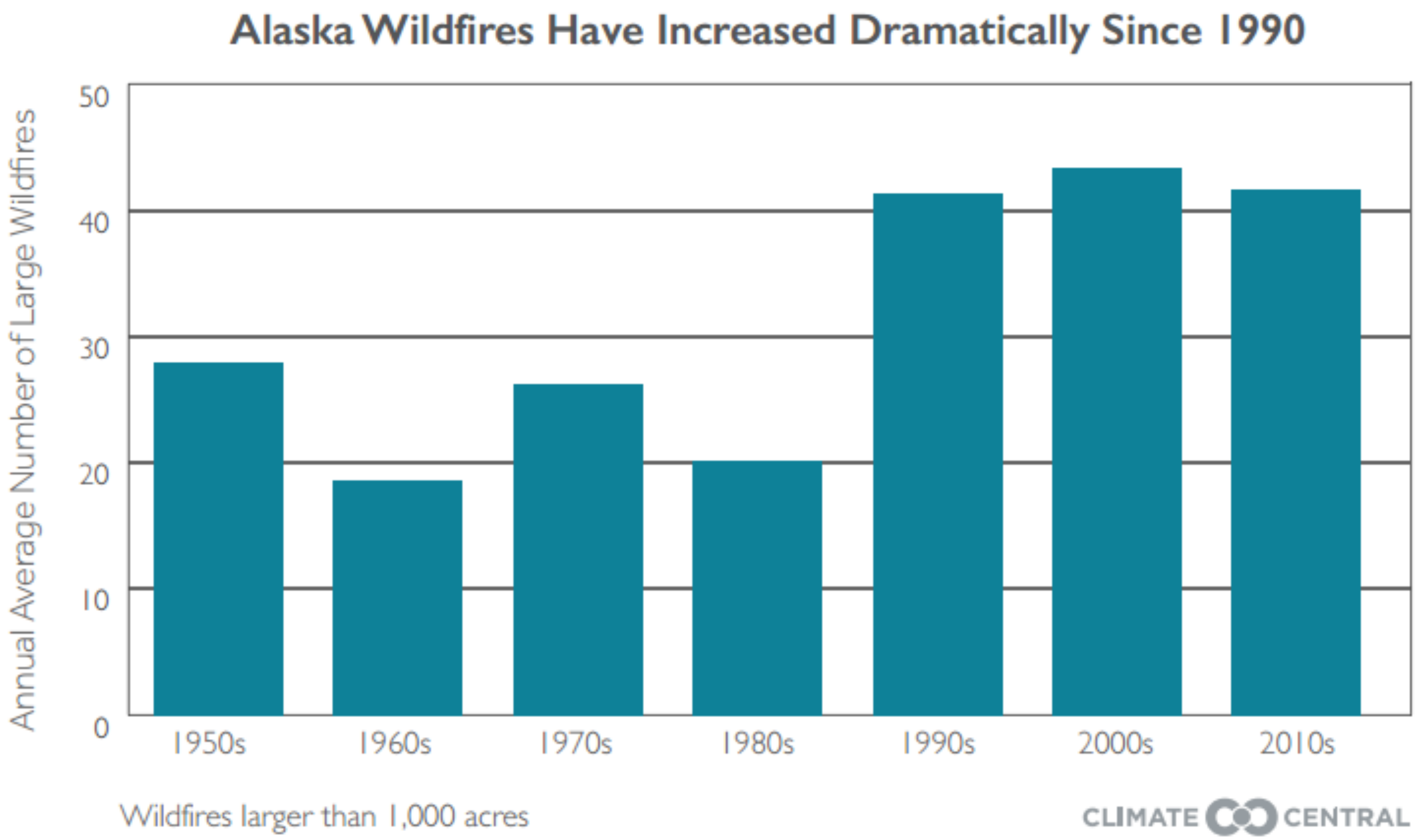


https://www.ncdc.noaa.gov/societal-impacts/wildfires

Wildfires

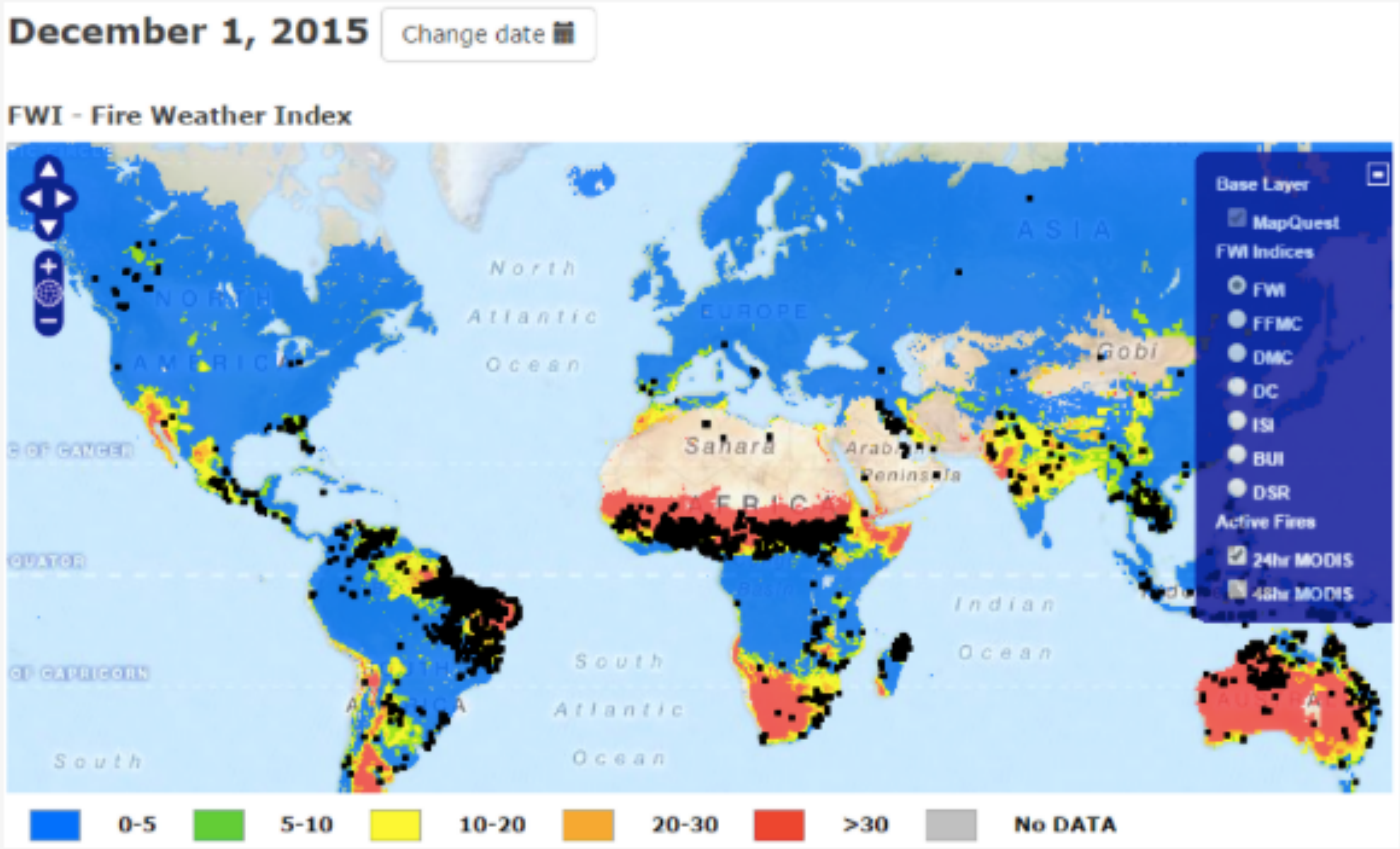
Wild fires and climate change

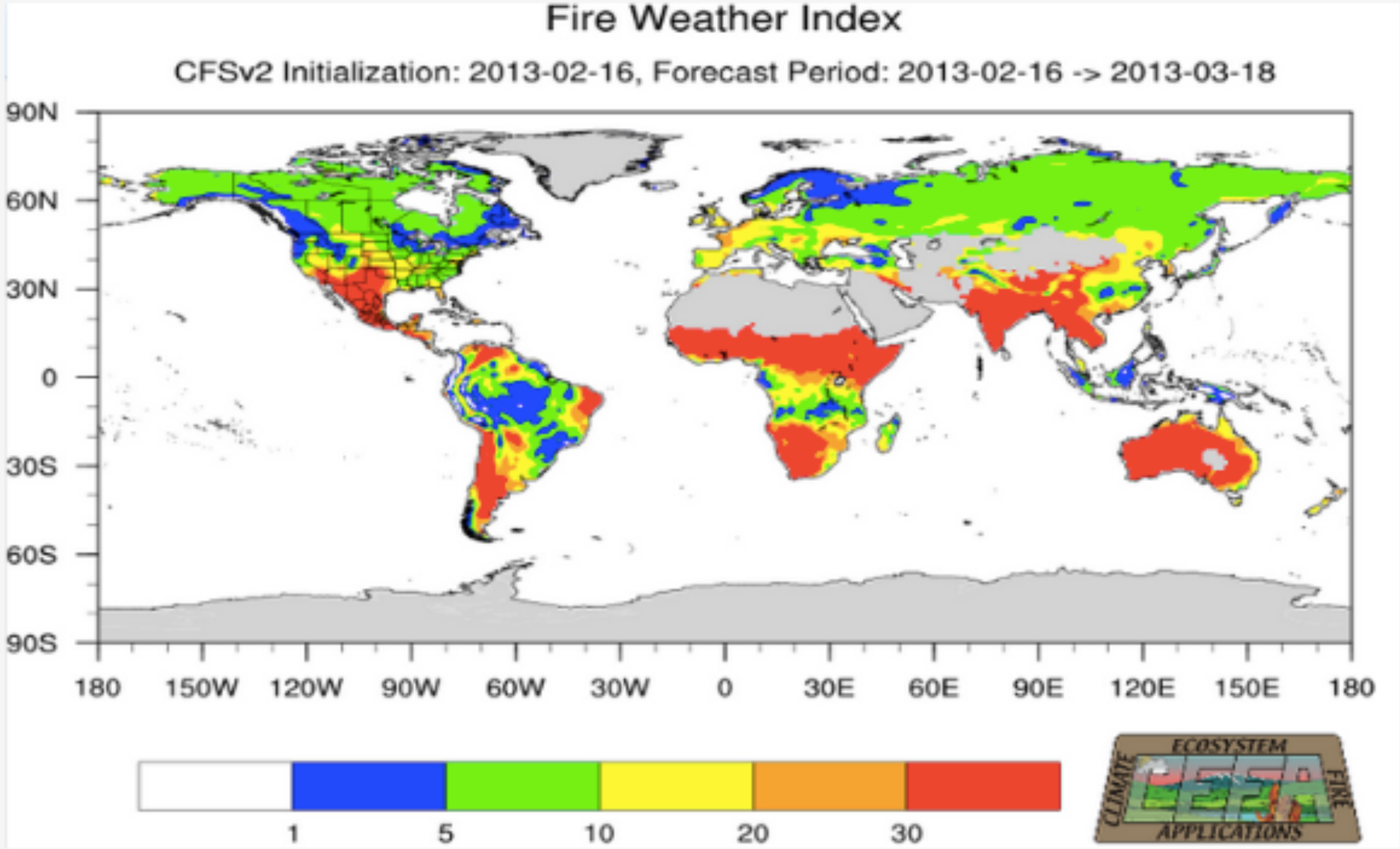




Wildfire monitoring

Mapping Products

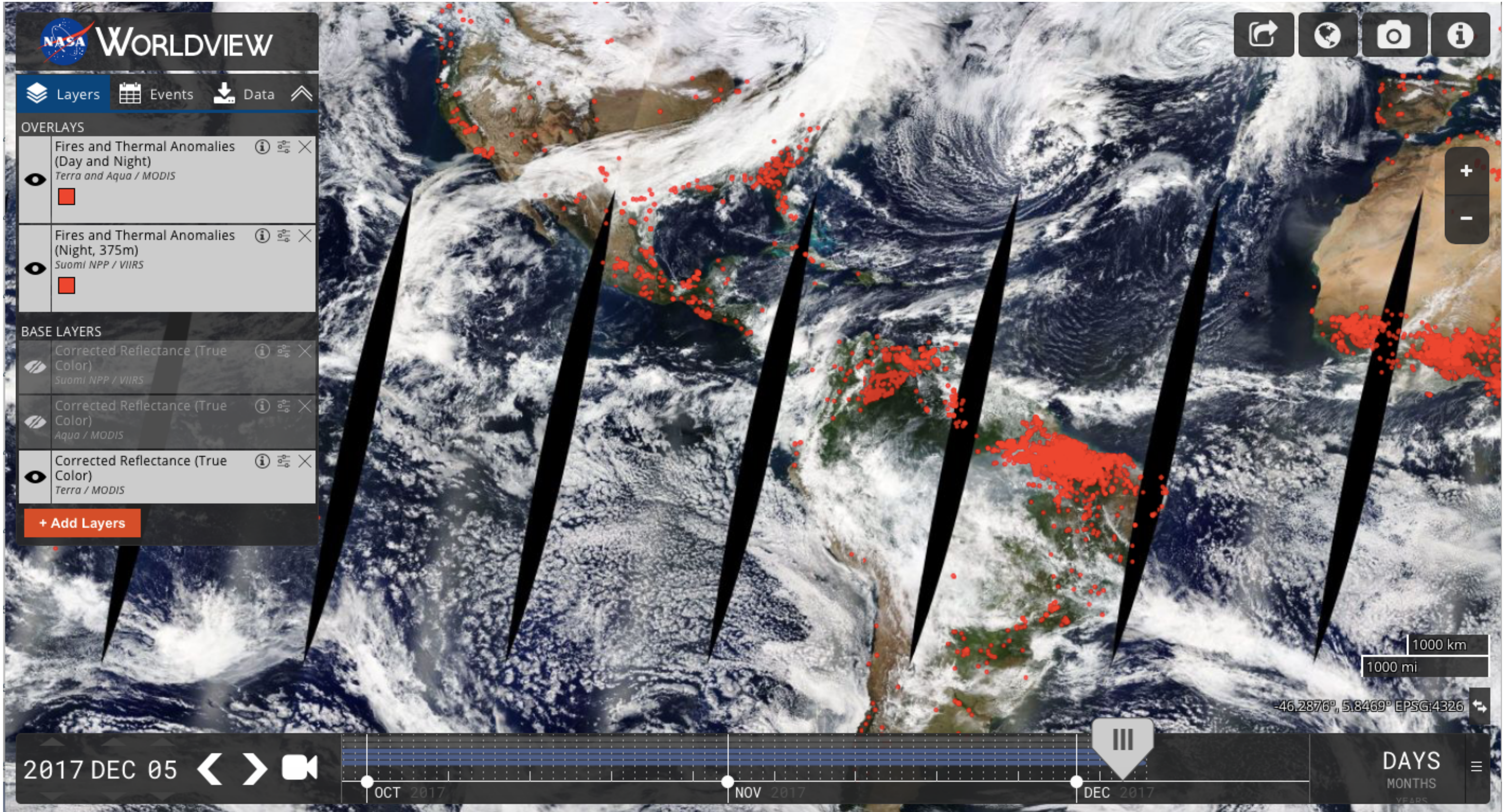




http://www.fire.uni-freiburg.de/gwfews/index.html

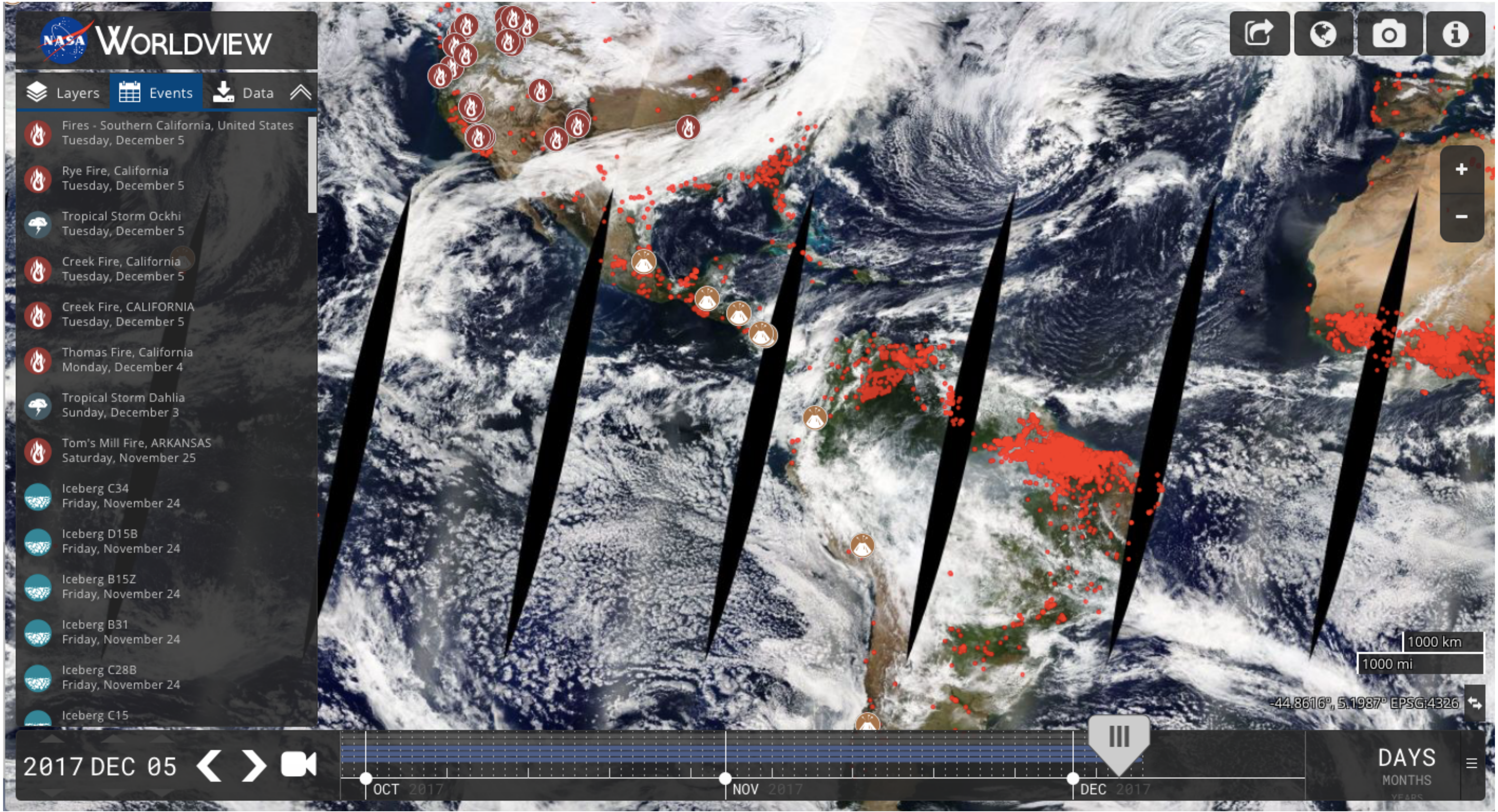
Wildfires

https://worldview.earthdata.nasa.gov/?p=geographic&l=VIIRS_SNPP_CorrectedReflectance_TrueColor(hidden),MODIS_Aqua_CorrectedReflectance_TrueColor(hidden),MODIS_Terra_CorrectedReflectance_TrueColor,MODIS_Fires_All,VIIRS_SNPP_Fires_375m_Night&t=2017-12-05&z=3&v=-177.0732421875,-46.80615234375,5.9765625,52.75634765625



Wildfires

https://worldview.earthdata.nasa.gov/



Natural Hazards and Disaster

Class 27: Climate Change Impacts

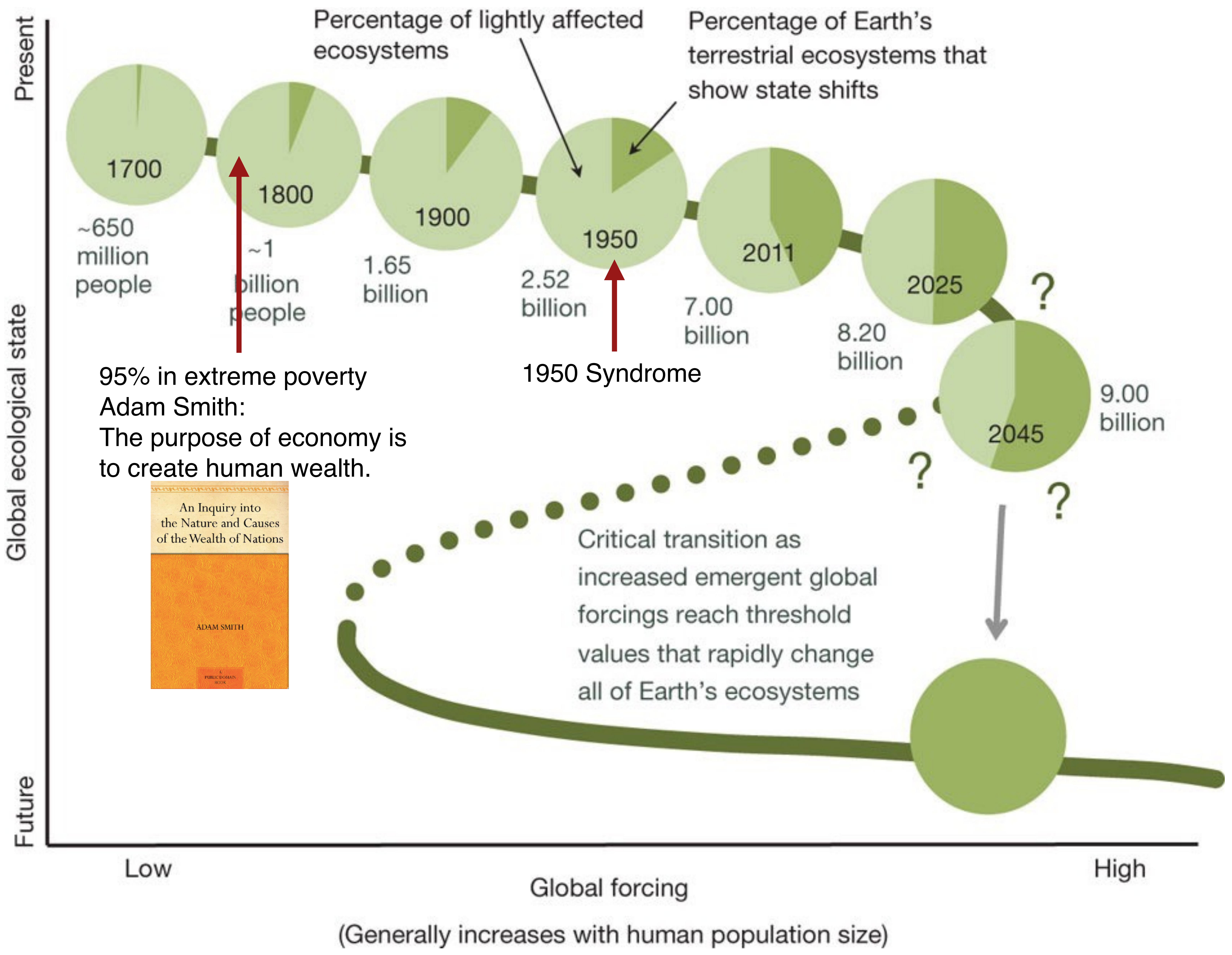
- Sea Level Rise
- Heat Waves
- Droughts
- Cold Spells
- Wildfires
- Land use, biological hazards, extinction

Natural Hazards and Disaster

Class 27: Climate Change Impacts

- Sea Level Rise
- Heat Waves
- Droughts
- Cold Spells
- Wildfires
- Land use, biological hazards, extinction

Land use, biological hazards, extinction

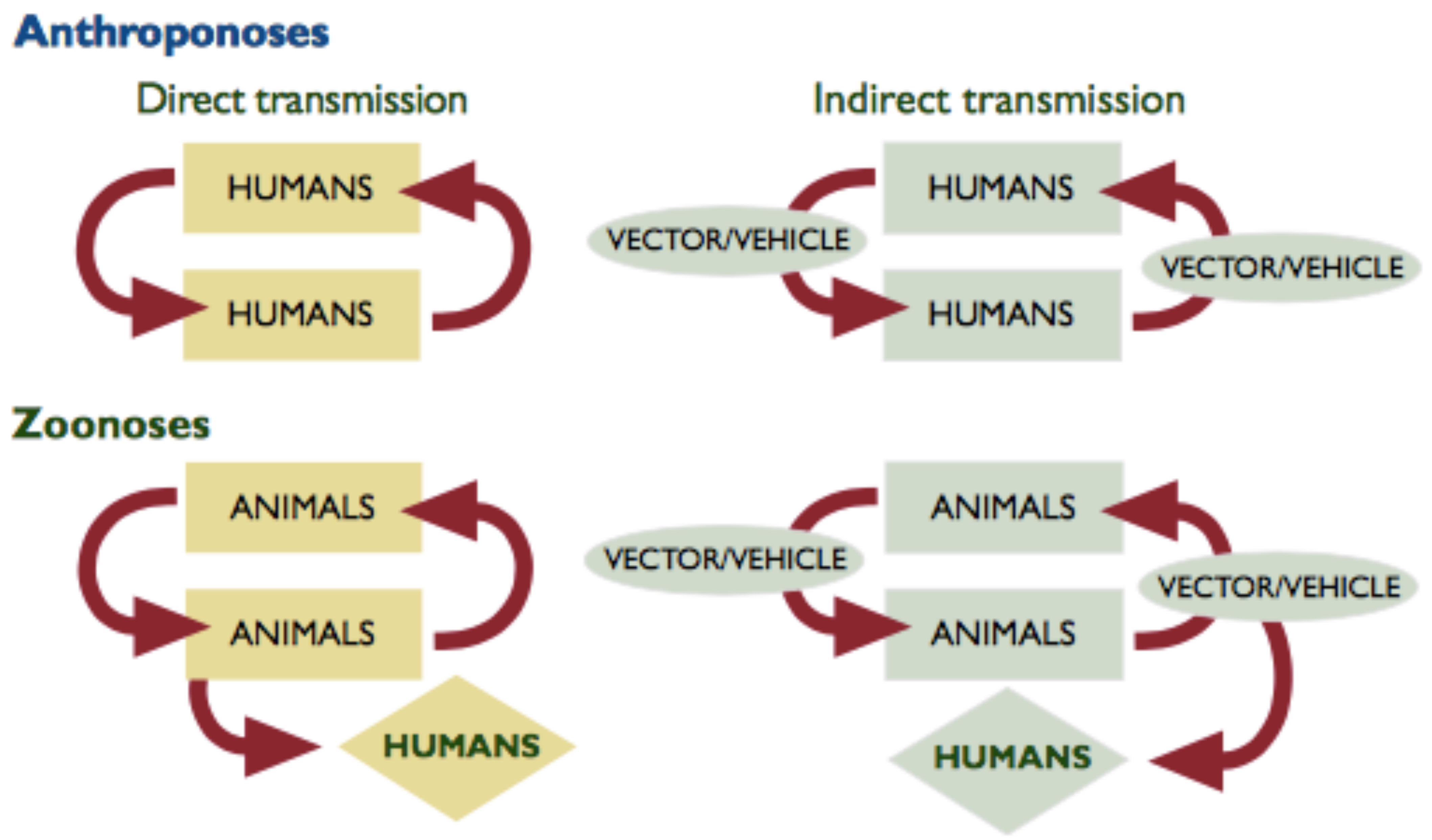


Land use, biological hazards, extinction

Biological Hazards: Sources of biological hazards may include **bacteria, viruses, insects, plants, birds, animals**, and humans. These sources can cause a variety of health effects ranging from skin irritation and allergies to infections (e.g., tuberculosis, AIDS), cancer and so on.

Infectious diseases

Figure 6.1: Four main types of transmission cycle for infectious diseases (reference 5)



http://www.who.int/globalchange/environment/en/chapter6.pdf

Table 6.1: Examples of how diverse environmental changes affect the occurrence of various infectious diseases in humans (Refernce 5)

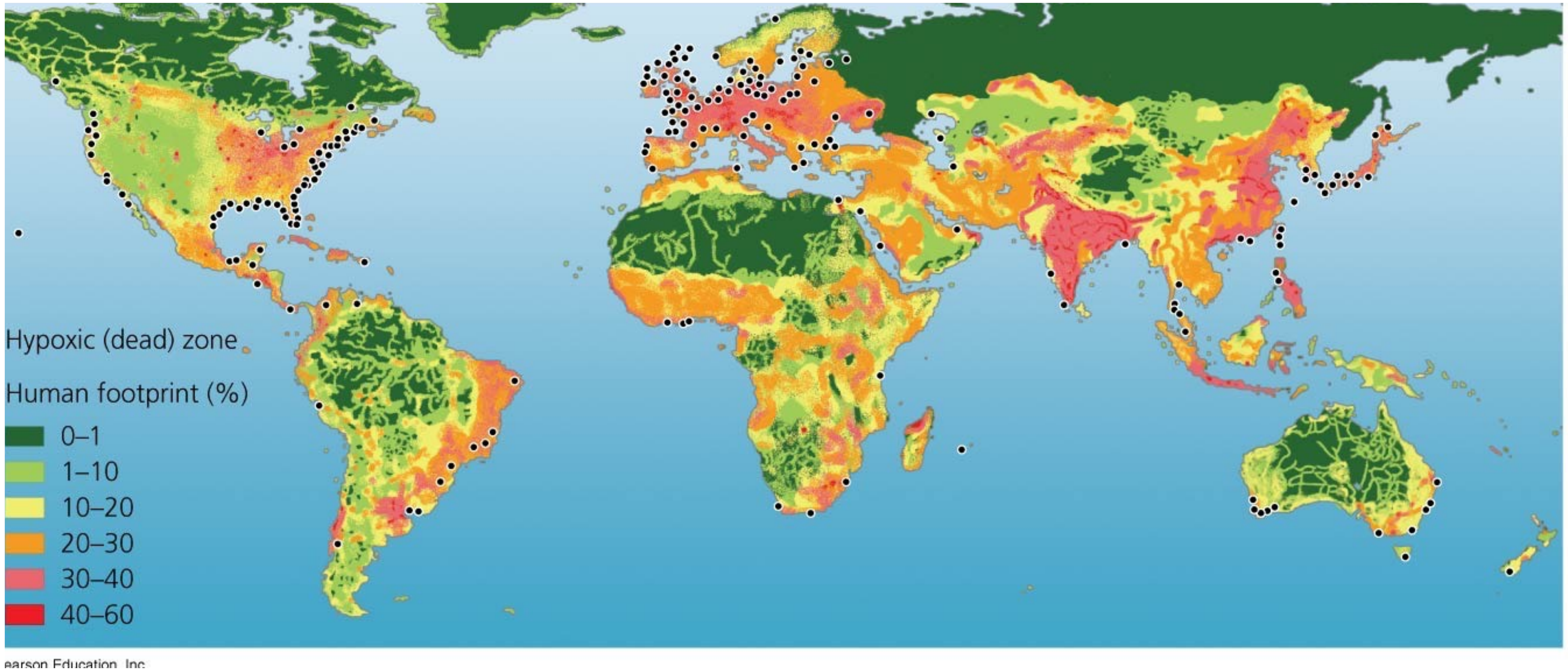
Environmental changes	Example diseases	Pathway of effect
Dams, canals, irrigation	Schistosomiasis	▲ Snail host habitat, human contact
	Malaria	▲ Breeding sites for mosquitoes
	Helminthiasies	▲ Larval contact due to moist soil
	River blindness	▼ Blackfly breeding, ▼ disease
Agricultural intensification	Malaria	Crop insecticides and ▲ vector resistance
	Venezuelan haemorraghic fever	▲ rodent abundance, contact
Urbanization, urban crowding	Cholera	▼ sanitation, hygiene; ▲ water contamination
	Dengue	Water-collecting trash, ▲ *Aedes aegypti* mosquito breeding sites
	Cutaneous leishmaniasis	▲ proximity, sandfly vectors
Deforestation and new habitation	Malaria	▲ Breeding sites and vectors, immigration of susceptible people
	Oropouche	▲ contact, breeding of vectors
	Visceral leishmaniasis	▲ contact with sandfly vectors
Reforestation	Lyme disease	▲ tick hosts, outdoor exposure
Ocean warming	Red tide	▲ Toxic algal blooms
Elevated precipitation	Rift valley fever	▲ Pools for mosquito breeding
	Hantavirus pulmonary syndrome	▲ Rodent food, habitat, abundance

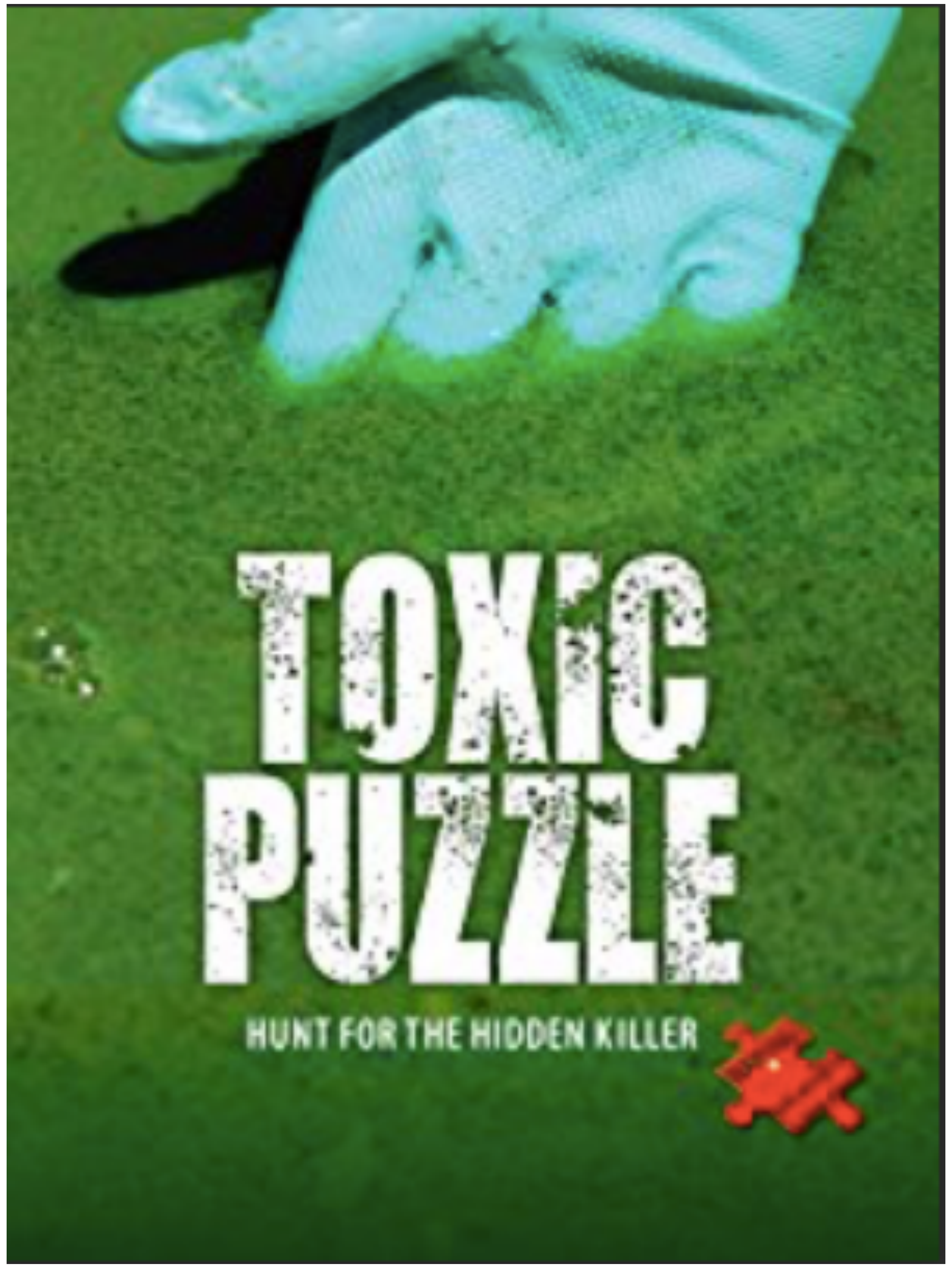
▲ increase ▼ reduction

Land use, biological hazards, extinction

Biological Hazards: Sources of biological hazards may include **bacteria, viruses, insects, plants, birds, animals**, and humans. These sources can cause a variety of health effects ranging from skin irritation and allergies to infections (e.g., tuberculosis, AIDS), cancer and so on.

Toxic products …





… about toxic substances produced by cyanobacteria …

Land use, biological hazards, extinction

Biological Hazards: Sources of biological hazards may include **bacteria, viruses, insects, plants, birds, animals**, and humans. These sources can cause a variety of health effects ranging from skin irritation and allergies to infections (e.g., tuberculosis, AIDS), cancer and so on.

Ecosystem impacts

An invasive species is a plant, fungus, or animal species that is not native to a specific location, which has a tendency to spread to a degree that can cause damage to the non-human and human environment, including human economy and human health.

Forests and Insects: While native insects and diseases contribute to the death of old and stressed trees and lead the way to the regeneration of trees and forests, non-native insects and pathogens can dramatically alter this cycle.

Land use, biological hazards, extinction

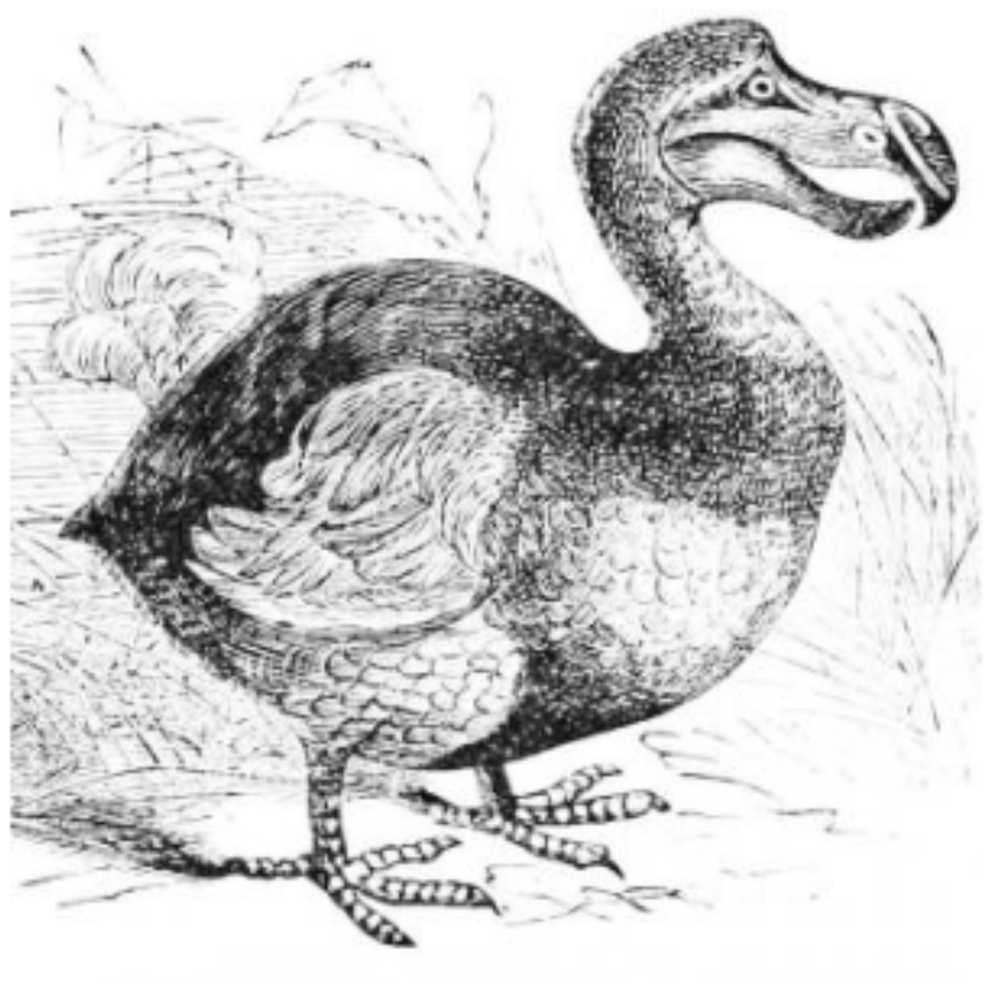
BROWN UNIVERSITY

Google™ Custom Search

About Brown | Academics | Admission | Research | Campus Life | A TO Z INDEX | PEOPLE DIRECTORY

News from Brown

News | For Journalists | Featured Events | Search Brown News



An order of magnitude
A new and more precise recalculation of the normal background extinction rate — what it would be without the human presence — shows the rate to be lower, meaning that the rate of extinction in the human era is as much as 10 times worse than had been thought.
Image: Wikimedia Commons

Extinctions during human era worse than thought

September 2, 2014 Media contact: David Orenstein 401-863-1862

The gravity of the world's current extinction rate becomes clearer upon knowing what it was before people came along. A new estimate finds that species die off as much as 1,000 times more frequently nowadays than they used to. That's 10 times worse than the old estimate of 100 times.

PROVIDENCE, R.I. [Brown University] — It's hard to comprehend how bad the current rate of species extinction around the world has become without knowing what it was before people came along. The newest estimate is that the pre-human rate was 10 times lower than scientists had thought, which means that the current level is 10 times worse.

Extinctions are about 1,000 times more frequent now than in the 60 million years before people came along. The explanation from lead author Jurriaan de Vos, a Brown University postdoctoral researcher, senior author Stuart Pimm, a Duke University professor, and their team appears online in the journal *Conservation Biology*.

In absolute, albeit rough, terms the paper calculates a "normal background rate" of extinction of 0.1 extinctions per million species per year. That revises the figure of 1 extinction per million species per year that Pimm estimated in prior work in the 1990s. By contrast, the current extinction rate is more on the order of 100 extinctions per million species per year.

https://news.brown.edu/articles/2014/09/extinctions

Final Word

Mitigation: Reduce flows and growth

- New economy - how new?
- Social and Solidarity Economy; United Nations Research Institute for Sustainable Development (UNRISD)?
- Not enough to think about distribution, have to ask about the purpose of economy.
- Dual purpose economy: creating human wealth while safeguarding the Earth's life-support system.

Mitigation: Reduce flows and growth

- New economy - how new?
- Social and Solidarity Economy; United Nations Research Institute for Sustainable Development (UNRISD)?
- Not enough to think about distribution, have to ask about the purpose of economy.
- Dual purpose economy: creating human wealth while safeguarding the Earth's life-support system.

Adaptation: Prepare for surprises - antifragile

- old paradigms are no longer valid
- overcome normalcy bias
- develop foresight: living on a new planet full of surprises
- understand that humans many not be able to live everywhere on the planet

Mitigation: Reduce flows and growth

- New economy - how new?
- Social and Solidarity Economy; United Nations Research Institute for Sustainable Development (UNRISD)?
- Not enough to think about distribution, have to ask about the purpose of economy.
- Dual purpose economy: creating human wealth while safeguarding the Earth's life-support system.

Adaptation: Prepare for surprises - antifragile

- old paradigms are no longer valid
- overcome normalcy bias
- develop foresight: living on a new planet full of surprises
- understand that humans many not be able to live everywhere on the planet

Operation: Learn how to operate a planetary system

- Principle: Making it the job of people to do the right thing (based on Upton Sinclair's quote)
- Global effort: Sustainable Development Goals, 2030 Agenda for Sustainable Development
- Approach: organizing public services based on the SDGs

Mitigation: Reduce flows and growth

- New economy - how new?
- Social and Solidarity Economy; United Nations Research Institute for Sustainable Development (UNRISD)?
- Not enough to think about distribution, have to ask about the purpose of economy.
- Dual purpose economy: creating human wealth while safeguarding the Earth's life-support system.

Adaptation: Prepare for surprises - antifragile

- old paradigms are no longer valid
- overcome normalcy bias
- develop foresight: living on a new planet full of surprises
- understand that humans many not be able to live everywhere on the planet

Operation: Learn how to operate a planetary system

- Principle: Making it the job of people to do the right thing (based on Upton Sinclair's quote)
- Global effort: Sustainable Development Goals, 2030 Agenda for Sustainable Development
- Approach: organizing public services based on the SDGs

Action: Transition to an economy “that meet the needs of the present while safeguarding the Earth’s life-support system, on which the welfare of present and future generations depends.”